Metro Waste Authority

Metro Park West Landfill

Construction Documents Project Manual

P-66 – MPW Scalehouse

Issued for Bid

June 14, 2024

2499 337th Street
Perry, Iowa 50220

hdrinc.com
(402) 399-1000
1917 S 67th Street
Omaha, NE 68106

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SEALS AND SIGNATURES

Owner Name: Metro Waste Authority
Facility or Site Name: Metro Park West
Project Name: Scalehouse Construction
Project or Contract Designation: P-66
Engineer: HDR

 Katie Kinley, PE License No. P26201	I hereby certify that the portion of the Specification described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa. Divisions or Sections of this project manual covered by this seal: • Divisions 01, 02, 32, 33, and 40 • Section 31 10 00 and 31 23 33 Katie Kinley 6-14-24
 Svein K. Magnussen, PE License No. 23213	I hereby certify that the portion of the Specification described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa. Divisions or Sections of this project manual covered by this seal: • Divisions 03 and 06 • Sections 01 45 33, 05 50 00, and 31 23 00 Svein Magnussen 6/14/2024

 Randall L. Milbrath, Architect License No. 3203	I hereby certify that the portion of the Specification described below was prepared by me or under my direct supervision and that I am a duly registered Professional Architect under the laws of the State of Iowa. Divisions or Sections of this project manual covered by this seal: • Divisions 04, 05, 07, 08, 09, 10, and 12 • Sections 03 35 00, 03 35 43, and 06 41 00  6-14-24
 Kevin Vander Kolk, PE License No. 14688	I hereby certify that the portion of the Specification described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa. Divisions or Sections of this project manual covered by this seal: • Divisions 26 and 27 •  6-14-24
 Jeffrey A. Lewis, PE License No. 16827	I hereby certify that the portion of the Specification described below was prepared by me or under my direct supervision and that I am a duly registered Professional Engineer under the laws of the State of Iowa. Divisions or Sections of this project manual covered by this seal: • Divisions 22 and 23.  6/14/2024

Engineer's seal and signature does not apply to the documents that comprise Division 00, Bidding and Contracting Requirements.

It is a violation of applicable laws and regulations governing professional licensing and registration for any person, unless acting under the direction of the licensed and registered design professional(s) indicated above, to alter in any way the Specifications in this project manual.

END OF SEALS AND SIGNATURES

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DIVISION 00

PROCUREMENT AND CONTRACTING REQUIREMENTS

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METRO WASTE AUTHORITY
PERRY, IOWA
PROJECT P-66 – Scalehouse Construction

SECTION 00 10 00
NOTICE OF HEARING AND LETTING

Notice is hereby given that there are on file with Metro Waste Authority (the Authority), in the County of Boone and Greene, State of Iowa a request for proposal (RFP) for construction of a new scalehouse at the Metro Park West Landfill located in Perry, Iowa. Construction includes: excavation, loading, hauling, and structural fill placement, electrical, water, and septic installations, concrete and aggregate placement, building construction, fencing and gates, topsoiling, seeding and fertilizing, and erosion controls; and the work required by the Drawings and Specifications.

Sealed Bids for the design and construction of the **P-66 Scalehouse Construction (Project)** will be received, by the Authority, at the office of the **Metro Waste Authority, 300 E. Locust Street, Suite 100, Des Moines, Iowa 50309**, until **3:00 o'clock PM** local time on **July 8, 2024**, at which time the Bids received will be opened and publicly read by the Authority's representative. A hearing will be conducted on the RFP at a meeting of the Authority to be held at the Authority's office at 300 East Locust Street, Suite 100 in Des Moines, Iowa, at 5:45 PM, on July 17 2024, at which time and place any person may appear and file objections to the proposed RFP for said public improvements. Sealed bids previously received for such project will be presented to and considered by the Authority immediately after the termination of said hearing. Bids received will be acted upon at such time and place or at such later time and place as may then be fixed.

The Project shall be commenced on July 29, 2024. All work shall be completed including punch list, final walkthrough, and ready for final payment on or before November 15, 2024, subject to any extension of time which may be granted by the Authority.

Information and Bidding Documents for the Project can be obtained at the following designated website:

Quest Construction Data Network, LLC
http://www.questcdn.com
PO Box 412
Spring Park, MN 55384-0412
Telephone: (952) 233-1632
Email: info@questcdn.com

On http://www.questcdn.com, search for Quest eBidDoc #9182279

If downloading from QuestCDN for the first time, you will need to create a free membership account prior to downloading. Please contact QuestCDN for assistance with free membership registration, downloading and working with this digital project information. There will be no cost to the Bidder for downloading Bidding Documents from QuestCDN.

Bidding Documents may be downloaded from the designated website. Prospective Bidders are urged to register with the designated website as a Bidding Documents holder, even if Bidding Documents are obtained from a third-party plan room or source other than the designated website in either electronic or paper format. The designated website will be updated periodically with Addenda, lists of registered Bidding Documents holders, reports on the Site, and other information relevant to submitting a Bid for the Project. All official notifications, Addenda, and other Bidding Documents will be offered only through the designated website. Neither Owner nor Engineering will be responsible for Bidding Documents, including Addenda, if any, obtained from sources other than the designated website.

The Issuing Office for the Bidding Documents is:

HDR Engineering, Inc.
300 East Locust Street, Suite 210
Des Moines, IA 50309-1823

Attn. Katie Kinley
Phone (402) 392.6980
Email: katie.kinley@hdrinc.com

Prospective Bidders may review the Bidding Documents at the Issuing Office on Mondays through Fridays between the hours of 9:00 AM and 4:00 PM local time and may obtain copies of the Bidding Documents from the Issuing Office as described above, or by contacting the bid administrator, Katie Kinley at 402.392.6980. Paper copies of the Bidding Documents may be obtained from the Issuing Office by paying a deposit of $200 for each set. Bidders who return full sets of the Bidding Documents in good condition within 14 days after receipt of Bids will receive a full refund. Non-Bidders, and Bidders who obtain more than one set of the Bidding Documents, will receive a refund of $200 for documents returned in good condition within the time limit indicated above. Make deposit checks for Bidding Documents payable to HDR Engineering, Inc.

A non-mandatory pre-bid conference will be held on June 19, 2024, at 11 A.M. at the administrative office of the **Metro Park West Landfill, 2499 337th Street, Perry, Iowa 50220**. Bidders may arrange to visit the site at other times by contacting the bid administrator. Bids will be received for a single prime Contract. Bidder shall submit their terms and conditions for the Authority to review before entering into a contract. Bids shall be on a lump sum and unit price basis, with alternate bid items as indicated in the Bid Form, as required. Questions regarding project bidding will be received by the Authority and the Engineer until the end of day on June 28, 2024 from Bidders.

Each Bidder shall accompany a bid with a bid security. Bid security shall be furnished in accordance with the Instructions to Bidders.

A summary of information included herein is provided below for the Prospective Bidder's convenience:

Project Title:	MWA Project P-66 – Scalehouse Construction
Project Description:	Project Consists of the Following Major Elements at the Metro Park West Landfill: • Building Construction • Septic field installation • Alternate Bid items for solar and battery installation
Project Location(s):	Metro Park West Landfill, 2499 337th Street, Perry, Iowa 50220
Public Hearing:	July 17, 2024
Issuing Office:	HDR Engineering, Inc. 300 East Locust Street, Suite 210 Des Moines, Iowa 50309-1823 Katie Kinley, katie.kinley@hdrinc.com
Bid Opening:	July 8, 2024 at 3:00 PM local time
Bid Award	July 17, 2024 at 5:45 PM local time
Submit Bids To:	Metro Waste Authority Attn: Brian Wambold 300 East Locust Street, Suite 100 Des Moines, IA 50309
Project Dates:	Commencement: July 29, 2024 Substantial Completion: October 31, 2024 All Work complete for final billing by November 15, 2024

The Authority reserves the right to reject any or all bids, to re-advertise for new bids and to waive informalities that may be in the best interests of the Authority.

Published upon order of the Authority.

Owner: **Metro Waste Authority**

By: **Brian Wambold**

Title: **Operations Manager**

Date: June 14, 2024

+ + END OF ADVERTISEMENT FOR BIDS + +

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SECTION 00 20 00
SUGGESTED INSTRUCTIONS TO BIDDERS

ARTICLE 1 – DEFINED TERMS

1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:

A. *Issuing Office* – The office from which the Bidding Documents are to be issued.

ARTICLE 2 – COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents may be obtained from the Issuing Office in the number and format stated in the Notice of Hearing and Letting.

2.02 Complete sets of Bidding Documents shall be used in preparing Bids; neither Owner nor Engineer assumes any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.03 Owner and Engineer, in making copies of Bidding Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not authorize or confer a license for any other use.

2.04 Electronic Copies of Files:

A. Electronic copies of AutoCAD 2020 (.DWG) model files of existing and proposed surfaces from the Contract Document Drawings will be made available for informational purposes only to plan holders on Digital Compact Discs (CDs or flash drives) included with the hard copy Contract Documents.

B. Recipients of these electronic files, by virtue of opening the files, agree to and accept the following disclaimer and indemnification provisions which have been embedded in the CD's and included with the model files:

1. "The data contained in this electronic media is an instrument of service prepared by HDR Engineering, Inc. (Engineer) for the Metro Waste Authority (Owner) and is the exclusive property of the Engineer.

2. Any unauthorized reuse of the data contained herein by the recipient shall be at the recipient's sole risk.

3. By opening this file the recipient agrees to indemnify, defend and hold harmless the Engineer and Owner from any claims or liability allegedly arising from such actions.

4. Because data stored in electronic media format can deteriorate or be modified inadvertently, or otherwise, without authorization of the data's creator, the party receiving electronic files agrees this data furnished by Owner or Engineer to recipient in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party.

5. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk.

6. This may not be a complete set of Conformed Drawings, figures, sketches, calculations, attachments, and information and does not contain changes, clarifications, supplements, interpretations which result from actual construction, field order, change orders, change directives, and Owner supplements, except as specifically noted.

7. These Documents are complementary to and must be used in conjunction with the other Drawings and Technical Specifications. Bidding and Contract Document documentation that may be relied upon are limited to the printed copies (also known as hard copies) distributed by the Owner or Engineer.

8. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

9. In transferring documents in electronic format, the transferring party makes no representations as to the current or long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

10. The system software from which the digital files were created is AutoCAD Version 2020.

11. Surface data may additionally be presented in .XML format and displayed in both TIN and Polyline format."

ARTICLE 3 – QUALIFICATIONS OF BIDDERS

3.01 To demonstrate Bidder's qualifications to perform the Work, Bidder shall submit with its Bid (a) written evidence establishing its qualifications such as financial data, previous experience, and present commitments, and (b) the following additional information:

A. Evidence of Bidder's authority to do business in the state where the Project is located.

B. Bidder's state or other contractor license number, if applicable.

C. Subcontractor and Supplier qualification information.

D. Other required information regarding qualifications.

3.02 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

3.03 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

3.04 Bidder is advised to carefully review those portions of the Bid Form requiring Bidder's representations and certifications.

ARTICLE 4 – SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

4.01 *Site and Other Areas*

A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

4.02 *Existing Site Conditions*

A. Subsurface and Physical Conditions; Hazardous Environmental Conditions:

1. The Supplementary Conditions identify:

a. those reports known to Owner of explorations and tests of subsurface conditions at or adjacent to the Site.

b. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

c. reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.

d. Technical Data contained in such reports and drawings.

2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.

3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.

B. Underground Facilities: Information and data shown or indicated in the Bidding Documents with respect to existing Underground Facilities at or adjacent to the Site are set forth in the Contract Documents and are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

C. Adequacy of Data: Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions, and Underground Facilities, and possible changes in the Bidding Documents due to differing or unanticipated subsurface or physical conditions appear in Paragraphs 5.03, 5.04, and 5.05 of the General Conditions. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to a Hazardous Environmental Condition at the Site, if any, and possible changes in the Contract Documents due to any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work, appear in Paragraph 5.06 of the General Conditions.

4.03 *Site Visit and Testing by Bidders*

A. Bidder shall conduct Site visits during normal working hours in coordination with Brian Wambold of MWA at the site and shall not disturb any ongoing operations at the Site.

B. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.

C. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site.

D. Bidder shall comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.

E. 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.

4.04 *Owner's Safety Program*

A. Site visits and work at the Site may be governed by an Owner safety program. As the General Conditions indicate, if an Owner safety program exists, it will be noted in the Supplementary Conditions.

4.05 *Other Work at the Site*

A. Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.

ARTICLE 5 – BIDDER'S REPRESENTATIONS

5.01 It is the responsibility of each Bidder before submitting a Bid to:

A. examine and carefully study the Bidding Documents, and any data and reference items identified in the Bidding Documents;

B. visit the Site, conduct a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfy itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings;

E. consider the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs;

F. agree, based on the information and observations referred to in the preceding paragraph, that at the time of submitting its Bid no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

G. become aware of the general nature of the work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents;

H. promptly give Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder discovers in the Bidding Documents and confirm that the written resolution thereof by Engineer is acceptable to Bidder;

I. determine that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work; and

J. agree that the submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 6 – PRE-BID CONFERENCE

6.01 A pre-Bid conference will be held at the time and location stated in the Notice of Hearing and Letting (Section 00 10 00). Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 7 – INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all parties recorded as having received the Bidding Documents. Questions received less than seven days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, supplement, or change the Bidding Documents.

ARTICLE 8 – BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates, if applicable) and in the form of a certified check, bank money order, or a Bid bond (on the form included in the Bidding Documents) issued by a surety meeting the requirements of Paragraphs 6.01 and 6.02 of the General Conditions.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract Documents, furnished the required contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and exercise its rights under the Bid Bond. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults.

8.03 Owner shall promptly return the Bid security of unsuccessful bidders to the bidders as soon as the successful bidder is determined or within thirty (30) days, whichever is sooner.

ARTICLE 9 – CONTRACT TIMES

9.01 The number of days within which, or the dates by which, Milestones are to be achieved and the Work is to be substantially completed, and completed and ready for final payment, are set forth in the Agreement.

ARTICLE 10 – LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 11 – SUBSTITUTE AND "OR-EQUAL" ITEMS

11.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or "or-equal" items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or "or-equal" item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.

11.02 All prices that Bidder sets forth in its Bid shall be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as supplemented by

Addenda. Any assumptions regarding the possibility of post-Bid approvals of "or-equal" or substitution requests are made at Bidder's sole risk.

ARTICLE 12 – SUBCONTRACTORS, SUPPLIERS, AND OTHERS

12.01 A Bidder shall be prepared to retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of the Work if required by the Bidding Documents (most commonly in the Specifications) to do so. If a prospective Bidder objects to retaining any such Subcontractor, Supplier, or other individual or entity, and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.

12.02 Subsequent to the submittal of the Bid, Owner may not require the Successful Bidder or Contractor to retain any Subcontractor, Supplier, or other individual or entity against which Contractor has reasonable objection.

12.03 The apparent low Bidder, and any other Bidder so requested, shall within five days after Bid opening, submit to Owner a list, on the form entitled *Tabulation of Subcontractors and Suppliers* attached hereto as Exhibit A, of the Subcontractors and Suppliers proposed for the portions of the Work as identified on Exhibit A.

If requested by Owner, such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, or other individual or entity. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request the apparent low Bidder to submit an acceptable substitute, in which case apparent low Bidder shall submit a substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, or other individuals or entities. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.06 of the General Conditions.

ARTICLE 13 – PREPARATION OF BID

13.01 The Bid Form is included with the Bidding Documents.

A. All blanks on the Bid Form shall be completed in ink and the Bid Form signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid Form. A Bid price shall be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.

B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words "No Bid" or "Not Applicable."

13.02 A Bid by a corporation shall be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation shall be shown. The corporate seal shall be affixed and attested by the corporate secretary or an assistant corporate secretary.

13.03 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The partnership's address for receiving notices shall be shown.

13.04 A Bid by a limited liability company shall be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the firm's address for receiving notices shall be shown.

13.05 A Bid by an individual shall show the Bidder's name and address for receiving notices.

13.06 A Bid by a joint venture shall be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture's address for receiving notices shall be shown.

13.07 All names shall be printed in ink below the signatures.

13.08 The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Bid Form.

13.09 Postal and e-mail addresses and telephone number for communications regarding the Bid shall be shown.

13.10 The Bid shall contain evidence of Bidder's authority and qualification to do business in the state where the Project is located, or Bidder shall covenant in writing to obtain such authority and qualification prior to award of the Contract and attach such covenant to the Bid. Bidder's state contractor license number, if any, shall also be shown on the Bid Form.

ARTICLE 14 – BASIS OF BID

14.01 *Lump Sum / Unit Price*

A. Bidders shall submit a Bid on a firm fixed price basis for both lump sum and unit price items as set forth in the Bid Form.

14.02 *Unit Price*

A. Bidders shall submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.

B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity" (which Owner or its representative has set forth in the Bid Form) for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.

C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

14.03 *Allowances*

A. For cash allowances see Section 01 21 00.

ARTICLE 15 – SUBMITTAL OF BID

15.01 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 7 of the Bid Form.

15.02 A Bid shall be received no later than the date and time prescribed and at the place indicated in the Notice of Hearing and Letting and shall be enclosed in a plainly marked package with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted), the name and address of Bidder, and shall be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid shall be addressed to:

ATTN: Brian Wambold
Metro Waste Authority
300 East Locust Street, Suite 100
Des Moines, IA 50309

15.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 16 – MODIFICATION AND WITHDRAWAL OF BID

16.01 A Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

16.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 16.01 and submit a new Bid prior to the date and time for the opening of Bids.

16.03 If within 24 hours after Bids are opened any Bidder files a duly signed written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, that Bidder will be disqualified from further bidding on the Work.

ARTICLE 17 – OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Notice of Hearing and Letting, unless obviously non-responsive, and read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 – BIDS TO REMAIN SUBJECT TO ACCEPTANCE

18.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 19 – EVALUATION OF BIDS AND AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible. If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, then the Owner will reject the Bid as nonresponsive; provided that Owner also reserves the right to waive all minor informalities not involving price, time, or changes in the Work.

19.02 If Owner awards the contract for the Work, such award shall be to the lowest responsive, responsible Bidder.

19.03 Evaluation of Bids:

A. In evaluating Bids, Owner will consider whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.

B. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.

19.04 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

19.05 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 20 – BONDS AND INSURANCE

20.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds and insurance. When the Successful Bidder delivers the Agreement (executed by Successful Bidder) to Owner, it shall be accompanied by required bonds and insurance documentation.

ARTICLE 21 – SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it shall be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder shall execute and deliver the required number of counterparts of the Agreement (and any bonds and insurance documentation required to be delivered by the Contract Documents) to Owner. Within ten days thereafter, Owner shall deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 22 – SALES AND USE TAXES

22.01 Owner is exempt from Iowa state sales and use taxes on materials and equipment to be incorporated in the Work. (Exemption No. 42-720039K). Said taxes shall not be included in the Bid. Refer to Paragraph SC-7.09 of the Supplementary Conditions for additional information.

EXHIBIT A

TABULATION OF SUBCONTRACTORS AND SUPPLIERS

Name of Firm Submitting Bid: _____

The following subcontractors and suppliers will be utilized for portions of the project work. Following submittal of this form, changes shall not be made unless the change(s) is approved by the Owner.

Subcontractor	Classification of Work	Estimated Dollar Amount
Supplier		Estimated Dollar Amount

SECTION 00 41 00
BID FORM
METRO WASTE AUTHORITY
PROJECT P-66 – SCALEHOUSE CONSTRUCTION

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

Metro Waste Authority
300 East Locust Street, Suite 100
Des Moines, IA 50309

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

2.02 BIDDER will sign and deliver the required number of counterparts of the AGREEMENT with the Bonds and other documents required by the Bidding Requirements within 15 days after the date of OWNER's Notice of Award.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

Addendum No.	Addendum, Date

B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

D. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.

E. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

F. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.

G. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and confirms that the written resolution thereof by Engineer is acceptable to Bidder.

H. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.

I. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

J. Bidder has examined and carefully prepared the proposal from the Bidding Documents and has checked the same in detail before submitting this Bid.

K. Bidder will submit written evidence of its authority to do business in the state where the Project is located not later than the date of its execution of the Contract.

L. Bidder agrees to waive any claim it has or may have against the Owner, the Engineer and the respective employees, arising out of or in connection with the administration, evaluation or recommendation of the Bid.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;

B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;

C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and

D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

Item No.	Description	Estimated Quantity	Unit	Bid Unit Price	Bid Price
101	Mobilization, demobilization, and all work not included in Bid Item Nos. 102 through 106	1	LS		
102	Construct Scalehouse	1	LS		
103	Construct Septic Field	2,500	SF		
104	Construct Surfacing at Scalehouse	20,000	SF		
105	Remove and Replace Unsuitable Soils	1,000	CY		
106	Seeding Disturbed Areas (Install Owner supplied amended topsoil. Install Seed, Fertilize, and Mulch)	2.0	AC		
107	Allowance (5% of Total Combined Price of Bid Items 101 – 106)	1	LS		
A108	Solar Panels – 18-kW	1	LS		
A109	Power wall – 13.5-kWh	1	LS		

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

Total Base Bid Price for Bid Items 101 through 107
(Total of Lump Sum and Unit Price Bids = Total Bid Price)

$ _____
(numerals)

_____
(words)

Total Alternate Bid Price for Bid Items 101 through 109
(Total of Lump Sum and Unit Price Bids = Total Alternate Bid Price)

$ _____
(numerals)

_____
(words)

5.02 If the Contract is to be awarded, it will be awarded to the lowest responsive Bidder for the Work selected by Owner (Items 101-107, with consideration of the alternate bid items, Items 101 – 109). Owner will select the Work that will be in the best interest of the Owner.

5.03 Contractor computed quantity for bulk excavation is not guaranteed. Daily operational activities may result in varying quantities of soil to be excavated. Contractor to provide alternate pricing for various quantities that may be encountered. Owner will confirm quantity of soil excavation in addition to base bid with Contractor during Contract Negotiations. Total amount will be the unit price multiplied by the highest quantity of the range. Contractor to provide both unit price and total amount for the highest quantity of the range for all line items.

5.04 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

5.05 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 6 – ATTACHMENTS TO THIS BID

6.01 The following documents are submitted with and made a condition of this Bid:

A. Required Bid security;

B. List of Project References;

C. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such license within the time for acceptance of Bids;

D. Required Bidder Qualification Statement with supporting data.

ARTICLE 7 – DEFINED TERMS

7.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 8 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

_____

By:
[Signature] _____

[Printed name] _____
(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:
[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

_____

_____

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail address: _____

_____

State Contractor's License
No.: _____
(where applicable)

END OF BID FORM

SECTION 00 43 50
BID BOND

Any singular reference to Bidder, Surety, Owner, or other party shall be considered plural where

BIDDER *(Name and Address)*:

SURETY *(Name, and Address of Principal Place of Business)*:

OWNER *(Name and Address)*:

BID

Bid Due Date:

Description *(Project Name— Include Location)*:

BOND

Bond Number:

Date:

Penal sum _____ $ _____

(Words) (Figures)

Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.

BIDDER	**SURETY**
_____ (Seal)	_____ (Seal)
Bidder's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

Note: Addresses are to be used for giving any required notice.
Provide execution by any additional parties, such as joint venture's, if necessary.
applicable.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder any difference between the total amount of Bidder's Bid and the total amount of the Bid of the next lowest, responsible Bidder that submitted a responsive Bid as determined by Owner for the work required by the Contract Documents, provided that:

1.1 If there is no such next Bidder, and Owner does not abandon the Project, then Bidder and Surety shall pay to Owner the penal sum set forth on the face of this Bond, and

1.2 In no event shall Bidder's and Surety's obligation hereunder exceed the penal sum set forth on the face of this Bond.

1.3 Recovery under the terms of this Bond shall be Owner's sole and exclusive remedy upon default of Bidder.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.

3. This obligation shall be null and void if:

3.1 Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or

3.2 All Bids are rejected by Owner, or

3.3 Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from Bid due date without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.

7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION 00 45 10
QUALIFICATION STATEMENT
FOR
METRO WASTE AUTHORITY
PROJECT P-66 – Scalehouse Construction

THE INFORMATION SUPPLIED IN THIS DOCUMENT IS CONFIDENTIAL TO THE EXTENT PERMITTED BY LAWS AND REGULATIONS

Note: Contractors who do not complete the following questionnaire are subject to being deemed "non-responsive".

1. SUBMITTED BY:

Official Name of Firm: _____

Address: _____

_____

_____

2. SUBMITTED TO: _____

3. SUBMITTED FOR: _____

Owner: _____

Project Name: _____

_____

_____

TYPE OF WORK: _____

_____

_____

4. CONTRACTOR'S CONTACT INFORMATION:

Contact Person: _____

Title: _____

Phone: _____

Email: _____

5. AFFILIATED COMPANIES:

Name: _____

Address: _____

_____

_____

6. CONTRACTOR INFORMATION:

All other names under which Contractor has operated in the past five (5) years.

_____

_____

_____

Federal Employee Identification Number: _____

7. TYPE OF ORGANIZATION (Check one):

☐ SOLE PROPRIETORSHIP

Name of Owner: _____

Doing Business As: _____

Date of Organization: _____

☐ PARTNERSHIP

Date of Organization: _____

Type of Partnership: _____

Name of General Partner(s): _____

_____

_____

☐ CORPORATION

State of Organization: _____

Date of Organization: _____

Executive Officers:

- President: _____

- Vice President(s): _____

_____

_____

- Treasurer: _____

- Secretary: _____

☐ LIMITED LIABILITY COMPANY

State of Organization: _____

Date of Organization: _____

Members: _____

_____

_____

_____

☐ JOINT VENTURE

Sate of Organization: _____

Date of Organization: _____

Form of Organization: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

_____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

8. REGISTRATION (Iowa Code Chapter 91C)

Contractor Registration Number: _____

Full Names of Registration Holders (as per Iowa Construction Contractor Registration requirements): _____

_____

_____

Contractor Registration Expiration Date: _____

9. LICENSING:

Jurisdiction: _____

Type of License: _____

License Number: _____

Jurisdiction: _____

Type of License: _____

License Number: _____

10. CERTIFICATIONS: CERTIFIED BY:

Disadvantage Business Enterprise: _____

Minority Business Enterprise: _____

Woman Owned Enterprise: _____

Small Business Enterprise: _____

Other (_____): _____

11. BONDING INFORMATION:

Bonding Company: _____

Address: _____

_____

Bonding Agent: _____

Address: _____

_____

_____

Contact Name: _____

Phone: _____

Aggregate Bonding Capacity: _____

Available Bonding Capacity as of date of this submittal: _____

12. FINANCIAL INFORMATION:

Financial Institution: _____

Address: _____

_____

Account Manager: _____

Phone: _____

Indicate approximate total bonding capacity of Contractor:

_____ $500,000 - $2,000,000
_____ $2,000,000 - $5,000,000
_____ $5,000,000 - $10,000,000

***INCLUDE AS AN ATTACHMENT AN AUDITED BALANCE SHEET FOR EACH OF THE LAST 3 YEARS**

13. SUSPENSION, REVOCATION, DEBARMENT:

a. Has Contractor's Registration ever been suspended or revoked in any jurisdiction?

□ Yes □ No

If Yes, provide information regarding suspension/revocation and attach all relevant documents.

b. Within the past five (5) years, has Contractor been debarred by any federal, state or local governmental entity from bidding on projects?

□ Yes □ No

If Yes, provide information regarding debarment and attach all relevant documents.

14. CONSTRUCTION EXPERIENCE:

a. On Schedule A or an equivalent attachment, provide details of projects currently under construction by Contractor (If joint venture, list participant's projects separately).
b. On Schedule B or an equivalent attachment, identify the individuals Contractor intends to be Officer in Charge, Project Manager, Project Superintendent, and any other key personnel on this Project. Include a resume and/or recent work history for each identified individual showing landfill construction related experience.

c. On Schedule C or an equivalent attachment, for work Contractor intends to self-perform on the Project, specify the level of training and experience each of Contactor's employees have had. Further indicate whether any such training has been in a United States Department of Labor ("DOL") certified apprentice program. In the event Contractor intends to utilize apprentice workers on the Project, Contractor must be able to provide, upon Owner's request, documentation that each apprentice worker utilized on the Project is properly registered as participating in a DOL certified apprentice program.

d. On Schedule D or an equivalent attachment, list Contractor's last five (5) completed projects and for each, the scheduled completion date and final completion date, noting any owner-approved extensions.
e. Has Contractor ever defaulted on a contract, or been disqualified, removed or otherwise prevented from bidding on, or completing any project?
□ Yes □ No
If yes, provide the year of the incident, name and address, phone number of the Owner of the project, the project name and location on an attachment.

f. Has Contractor ever failed to complete any work awarded to it?
□ Yes □ No

If yes, provide the year of the incident, name and address, phone number of the Owner of the project, the project name and location on an attachment.

g. Has any corporate officer, partner, joint venture participant or proprietor of Contractor ever failed to complete a construction contract awarded to him or her in his or her own name or when acting as a principal of another organization?

□ Yes □ No

If yes, provide the year of the incident, name and address, phone number of the Owner of the project, the project name and location on an attachment.

h. In the last five (5) years, has Contractor ever failed to substantially complete a project in a timely manner?

□ Yes □ No

If yes, provide the year of the incident, name and address, phone number of the Owner of the project, the project name and location on an attachment.

i. Does Contractor have projects not listed on Schedule A which commenced within the past four (4) years and have not reached final completion?

□ Yes □ No

If yes, provide the year of the incident, name and address, phone number of the Owner of the project, the project name and location.

j. Has Contractor ever been unable to obtain a bond or been denied a bond?

□ Yes □ No

If yes, provide all relevant details on an attachment.

k. On Schedule E, provide names of all surety/bonding companies Contractor has utilized in the past five (5) years. Include agent's name, address and phone number.

l. Has Contractor ever declared bankruptcy or been in receivership?

□ Yes □ No

If yes, provide all relevant details on an attachment.

m. Is Contractor currently being investigated for or previously been found to have violated in the last five (5) years any of the following state or federal laws: Iowa Minimum Wage Act, Iowa Non-English Speaking Employees Act, Iowa Child Labor Act, Iowa Labor Commissioner's Right to Inspect Premises, Iowa Compensation Insurance Act, Employment Security Act, Iowa Competition Act, Iowa Income, Corporate and Sales Tax Code, a "willful" violation of the Iowa or Federal Occupational Safety and Health Act, Iowa Employee Registration Requirements, Iowa Hazardous Chemical Risks Act, Iowa Wage Payment Collection Act, Federal Income and Corporate Tax Code, The National Insurance Security Act, The Fair Labor Standards Act:

□ Yes □ No

If yes, provide all relevant details on an attachment.

n. Are there any judgments, arbitration proceedings or suits pending or outstanding against Contractor or its officers?

□ Yes □ No

If yes, provide all relevant details on an attachment.

o. Has Contractor filed any lawsuit or demanded arbitration with regard to any construction contract within the past five (5) years?

□ Yes □ No

If yes, provide all relevant details on an attachment.

p. Has Contractor been found by a court or agency of competent jurisdiction to be delinquent in meeting its obligations under local, state or federal tax laws within the last five (5) years? For purposes of this Question, "delinquent" shall include, but is not limited to, failure to file, failure to pay, or imposition of tax liens.

□ Yes □ No

If yes, provide all relevant details on an attachment.

q. Contractor affirms that it will retain only subcontractors who can fully comply with the Bid Specifications.

□ Yes □ No

r. Contractor affirms that is will be responsible for ensuring that each subcontractor meets quality assurance Specifications as presented in the Bid Specifications.

□ Yes □ No

s. Contractor agrees to submit to Owner a list of all intended subcontractors at the time of bid. In the event Contractor wants to replace any originally-designated subcontractor, such may occur only with the approval of Owner. Such approval will not be unreasonably withheld.

□ Yes □ No

t. Contractor attests that it will comply with each of the following:

Iowa Minimum Wage Law:

□ Yes □ No

Maintain workers' compensation insurance or be qualified as a self-insurer and provide proof of insurance or ability to self-insure upon request:

□ Yes □ No

Properly license all Contractor employees with the appropriate licensing authority:

□ Yes □ No

u. Contractor will make available to Owner or its representative, upon request, documentation necessary to satisfy Owner, in its sole discretion, that Contractor's workers utilized on this Project are actual employees, with unemployment and worker's compensation coverage, and are not "leased employees" or independent contractors.

□ Yes □ No

v. Contractor will provide with this Statement of Bidder's Qualifications, the name, address, phone number and name of a contact person for three (3) entities that will provide references for Contractor.

□ Yes □ No

15. SAFETY PROGRAM:

a. Contractor will only utilize on-site employees who have completed the Occupational Safety and Health Act (OSHA) 10 Hour Construction Industry Training Program.

□ Yes □ No

b. State the general type(s) of work performed by Contractor with its own work force.

c. Describe Contractor's permanent safety program, and provide name(s) of individual(s) responsible for safety procedures on this Project.

d. Name of Contractor's Safety Officer: _____

e. Provide the following as attachments for (x) Contractor and (y) Contractor's proposed subcontractors and suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid:

i. OSHA No. 500-Log and Summary of Occupational Injuries & Illnesses for the past five (5) years.
□ See Attachment(s) □ None

ii. List of all OSHA Citations & Notifications of Penalty (monetary or other) received within the last five (5) years (indicate disposition as applicable).
□ See Attachment(s) □ None

iii. List of all safety citations or violations under any state all received within the last five (5) years (indicate disposition as applicable).
□ See Attachment(s) □ None

f. Provide the following for (x) Contractor and (y) Contractor's proposed subcontractors and suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid:

i. Workers' compensation Experience Modification Rate ("EMR") for the last five (5) years:

YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____
YEAR	_____	EMR	_____

ii. Total Recordable Frequency Rate ("TRFR") for the last five (5) years:

YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____
YEAR	_____	TRFR	_____

iii. Total number of man-hours worked for the last five (5) Years:

YEAR	_____	TOTAL NUMBER OF MAN-HOURS	_____
YEAR	_____	TOTAL NUMBER OF MAN-HOURS	_____
YEAR	_____	TOTAL NUMBER OF MAN-HOURS	_____
YEAR	_____	TOTAL NUMBER OF MAN-HOURS	_____
YEAR	_____	TOTAL NUMBER OF MAN-HOURS	_____

iv. Days Away From Work, Days of Restricted Work Activity or Job Transfer ("DART") incidence rate for the particular industry or type of Work to be performed by Contractor and each of Contractor's proposed Subcontractors and Suppliers) for the last five (5) years:

YEAR	_____	DART	_____
YEAR	_____	DART	_____
YEAR	_____	DART	_____
YEAR	_____	DART	_____
YEAR	_____	DART	_____

I hereby certify that: (1) all the information submitted in this Qualifications Statement, including any attachments, is true to the best of my knowledge and belief; (2) I am authorized to sign this Qualifications Statement on behalf of the Contractor whose name appears in Question 1 above; and (3) if any of the information I have provided herein becomes inaccurate, prior to execution of any Project contract, I will immediately provide Owner with updated accurate information in writing.

NAME OF ORGANIZATION: _____

BY: _____

TITLE: _____

DATED: _____

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS _____ DAY OF _____, 2023

NOTARY PUBLIC - STATE OF _____

MY COMMISSION EXPIRES: _____

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Contractor Key Personnel).
3. Schedule C (Contractor Employees – Level of Training and Experience).
4. Schedule D (Contractor's Last Five (5) Completed Projects).
5. Schedule E (Surety/Bonding Companies Contractor Utilized in Past Five (5) Years).
6. Audited balance sheet for each of the last 3 years for Contractor.
7. Evidence of authority for individuals in Section 7 to bind organization to an agreement.
8. Resumes of officers and key individuals (including Safety Officer) of Contractor.
9. Required safety program submittals listed in Section 15(e).
10. Additional items as pertinent.

END OF SECTION

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SCHEDULE A

CURRENT EXPERIENCE

Project Name	Owner's Contact Person	Design Engineer	Contract Date	Type of Work	Status	Cost of Work
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				
	Name: Address: Telephone:	Name: Company: Telephone:				

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SCHEDULE B
CONTRACTOR KEY PERSONNEL

Title	Name
Officer in Charge	
Project Manager	
Project Superintendent	

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SCHEDULE C

CONTRACTOR EMPLOYEES – LEVEL OF TRAINING AND EXPERIENCE

Employee Name	Level of Training	Experience

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SCHEDULE D

CONTRACTOR'S LAST FIVE (5) COMPLETED PROJECTS

Project Name	Owner's Contact Person	Project Location and Description	Scheduled Completion Date	Final Completion Date	Owner-Approved Extension?
	Name: Address: Telephone:				
	Name: Address: Telephone:				
	Name: Address: Telephone:				
	Name: Address: Telephone:				
	Name: Address: Telephone:				

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SCHEDULE E

SURETY/BONDING COMPANIES CONTRACTOR UTILIZED IN PAST 5 YEARS

Name of Surety/Bonding Company	Agent's Name, Address, Phone Number

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SECTION 00 52 00
AGREEMENT
BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

THIS AGREEMENT is by and between Metro Waste Authority ("Owner") and

_____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: Scalehouse construction includes: excavation, hauling, placement of structural fill, construction of foundation, concrete, building, electrical, plumbing, HVAC, fencing and gates, stormwater management, sediment removal, topsoiling, seeding and fertilizing, and erosion controls; and the work required by the Drawings and Specifications.

ARTICLE 2 – THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: P-66 Scalehouse Construction.

ARTICLE 3 – ENGINEER

3.01 The part of the Project that pertains to the Work, and which is not designated as delegated design to be completed by the Contractor, has been designed by HDR Engineering, Inc. (Design Engineer).

3.02 Both the Design Engineer and the construction quality assurance consultant ("Engineer") is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.01 *Time of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

A. The Work will be substantially completed on or before October 31, 2024, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before August November 15, 2024.

4.03 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner $2,000.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.02.A above for Substantial Completion until the Work is substantially complete.

2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $1,100.00 for each day that expires after such time until the Work is completed and ready for final payment.

3. Liquidated damages for failing to timely attain Substantial Completion and final completion are not additive and will not be imposed concurrently.

ARTICLE 5 – CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents the amounts that follow, subject to adjustment under the Contract:

A. For all Work other than Unit Price Work, a lump sum of: $[_____].

All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.

B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item):

Item No.	Description	Estimated Quantity	Unit	Bid Unit Price	Bid Price
101	Mobilization, demobilization, and all work not included in Bid Item Nos. 102 through 106	1	LS		
102	Construct Scalehouse	1	LS		
103	Construct Septic Field	2,500	SF		
104	Construct Access Road Grading and Surfacing	1	LS		
105	Remove and Replace Unsuitable Soils	1,000	CY		
106	Seeding Disturbed Areas (Install Owner supplied amended topsoil. Install Seed, Fertilize, and Mulch)	2.0	AC		
107	Allowance (5% of Total Combined Price of Bid Items 101 – 108)	1	LS		

Alternate Bid Item Work					
Item No.	**Description**	**Unit**	**Estimated Quantity**	**Unit Price**	**Extended Price**
A108	Solar Panels – 18-kW	1	LS		
A109	Power wall – 13.5-kWh	1	LS		

Alternate Bid Item Nos. Selected [_____].
$[_____]

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

C. Total of Lump Sum Amount, Unit Price Work (subject to final Unit Price adjustment), and Alternate Bid Items selected $[_____].

ARTICLE 6 – PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment each month, in accordance with Paragraph 15.01(D) of the General Conditions, during performance of the Work as provided in Paragraph 6.02.A.1 below and in accordance with Iowa Code Chapter 573, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract:

a. Ninety-five (95) percent of Work completed (with the balance being retainage).; and

b. Ninety-five (95) percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage)

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work in accordance with Paragraph 15.06 of the General Conditions, Owner shall pay the remainder of the Contract Price in accordance with Iowa Code Chapter 573 and as recommended by Engineer as provided in said Paragraph 15.06.

ARTICLE 7 – INTEREST

7.01 All amounts not paid when due shall bear interest at the rate in effect under Iowa Code section 12C.6, as of the day interest begins to accrue.

ARTICLE 8 – CONTRACTOR'S REPRESENTATIONS

8.01 In order to induce Owner to enter into this Contract, Contractor makes the following representations:

A. Contractor has examined and carefully studied the Contract Documents, and any data and reference items identified in the Contract Documents.

B. Contractor has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas, and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

C. Contractor is familiar with and is satisfied as to all Laws and Regulations that may affect cost, progress, and performance of the Work.

D. Contractor has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

E. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (3) Contractor's safety precautions and programs.

F. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.

G. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.

H. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

I. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

J. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

ARTICLE 9 – CONTRACT DOCUMENTS

9.01 *Contents*

A. The Contract Documents consist of the following:

1. This Agreement (pages 1 to 8, inclusive).
2. Performance bond (pages 1 to 3 inclusive).
3. Payment bond (pages 1 to 3 inclusive).
4. General Conditions (pages 1 to 65, inclusive).
5. Supplementary Conditions (pages 1 to 16, inclusive).
6. Specifications as listed in the table of contents of the Project Manual.
7. Drawings consisting of ___ sheets with each sheet bearing the following general title: ___.

8. Addenda (numbers ___ to ___, inclusive).

9. Exhibits to this Agreement (enumerated as follows):

   a. Contractor's Bid (pages ___ to ___, inclusive).

10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:

    a. Notice to Proceed.

    b. Work Change Directives.

    c. Change Orders.

    d. Field Orders.

B. The documents listed in Paragraph 9.01.A are NOT attached to this Agreement (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 9.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the General Conditions.

ARTICLE 10 – MISCELLANEOUS

10.01 *Terms*

A. Terms used in this Agreement will have the meanings stated in the General Conditions and the Supplementary Conditions.

10.02 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party hereto of any rights under or interests in the Contract will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

10.03 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

10.04 *Severability*

A. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

10.05 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 10.05:

   1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

   2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

10.06 *Other Provisions*

A. Owner stipulates that if the General Conditions that are made a part of this Contract are based on EJCDC® C-700, Standard General Conditions for the Construction Contract, published by the Engineers Joint Contract Documents Committee®, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

OWNER:	CONTRACTOR:
Metro Waste Authority	
By:	By:
Title:	Title:
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest:	Attest:
Title:	Title:
Address for giving notices:	Address for giving notices:
Metro Waste Authority	
300 E Locust, Suite 100	
Des Moines, Iowa 50309	
	State Contractor's No.:

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EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

SECTION 00 61 00
PERFORMANCE BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 18

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.

2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond shall arise after:

3.1 The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice shall indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 shall be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default;

3.2 The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and

3.3 The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.

4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 shall not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.

5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

5.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;

5.2 Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;

5.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or

5.4 Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or

5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:

7.1 the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and

resulting from the actions or failure to act of the Surety under Paragraph 5; and

7.3 liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.

8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.

9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price shall not be reduced or set off on account of any such unrelated obligations. No right of action shall accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.

10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

11. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Definitions

14.1 Balance of the Contract Price: The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.

14.2 Construction Contract: The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.

14.3 Contractor Default: Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.

14.4 Owner Default: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

14.5 Contract Documents: All the documents that comprise the agreement between the Owner and Contractor.

15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

16. In accordance with Iowa Code section 573.6, the following provisions shall be held to be a part of this Bond:

16.1 The Contractor and Surety on this Bond hereby agree to pay all persons, firms or corporations having contracts directly with the Contractor or with subcontractors, all just claims due to them for labor performed or materials furnished, in the performance of the contract on account of which this Bond is given, when the same are not satisfied out of the portion of the contract price which the Owner is required to retain until completion of the public improvement, but the Contractor and Surety shall not be liable to said persons, firms, or corporations unless the claims of said claimants against said portion of the contract price shall have been established as provided by law.

16.2 The Surety shall be deemed and held, any contract to the contrary notwithstanding, to consent without notice: (a) to any extension of time to the Contractor in which to perform the contract; (b) to any change in the plans, specifications, or contract, when such change does not involve an increase of more than twenty five percent (25%) of the total contract price, and shall then be released only as to such excess increase; and (c) that no provision of this Bond or of any other contract

shall be valid which limits to less than one (1) year from the time of the acceptance of the work the right to sue on this Bond for defects in the quality of the work or material not discovered or known to the oblige at the time such work was accepted.

17. This Bond shall be governed in accordance with the laws of the State of Iowa.

18. Modifications to this Bond are as follows:

EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

SECTION 00 61 50
PAYMENT BOND

CONTRACTOR *(name and address)*:

SURETY *(name and address of principal place of business)*:

OWNER *(name and address)*:

CONSTRUCTION CONTRACT
Effective Date of the Agreement:
Amount:
Description *(name and location)*:

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 20

Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth below, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL	**SURETY**
_____ *(seal)*	_____ *(seal)*
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	**By:** _____
Signature	Signature *(attach power of attorney)*
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	**Attest:** _____
Signature	Signature
_____	_____
Title	Title

Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party shall be considered plural where applicable.

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.

2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.

3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond shall arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.

4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.

5. The Surety's obligations to a Claimant under this Bond shall arise after the following:

    5.1 Claimants who do not have a direct contract with the Contractor,

        5.1.1 have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and

        5.1.2 have sent a Claim to the Surety (at the address described in Paragraph 13).

    5.2 Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).

6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.

7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:

    7.1 Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and

    7.2 Pay or arrange for payment of any undisputed amounts.

    7.3 The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 shall not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation shall not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

9. Amounts owed by the Owner to the Contractor under the Construction Contract shall be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfy obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.

11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

13. Notice and Claims to the Surety, the Owner, or the Contractor shall be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, shall be sufficient compliance as of the date received.

14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. When so furnished, the intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.

16. **Definitions**

16.1 **Claim:** A written statement by the Claimant including at a minimum:

1. The name of the Claimant;
2. The name of the person for whom the labor was done, or materials or equipment furnished;
3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
4. A brief description of the labor, materials, or equipment furnished;
5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
7. The total amount of previous payments received by the Claimant; and
8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.

16.2 **Claimant:** An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic's lien or similar statute against the real property upon which the Project is located. The intent of this Bond shall be to include without limitation in the terms of "labor, materials, or equipment" that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental

equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.

16.3 **Construction Contract:** The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.

16.4 **Owner Default**: Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.

16.5 **Contract Documents:** All the documents that comprise the agreement between the Owner and Contractor.

17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond shall be deemed to be Subcontractor and the term Owner shall be deemed to be Contractor.

18. In accordance with Iowa Code section 573.6, the following provisions shall be held to be a part of this Bond:

18.1 The Contractor and Surety on this Bond hereby agree to pay all persons, firms or corporations having contracts directly with the Contractor or with subcontractors, all just claims due to them for labor performed or materials furnished, in the performance of the contract on account of which this Bond is given, when the same are not satisfied out of the portion of the contract price which the Owner is required to retain until completion of the public improvement, but the Contractor and Surety shall not be liable to said persons, firms, or corporations unless the claims of said claimants against said portion of the contract price shall have been established as provided by law.

18.2 The Surety shall be deemed and held, any contract to the contrary notwithstanding, to consent without notice: (a) to any extension of time to the Contractor in which to perform the contract; (b) to any change in the plans, specifications, or contract, when such change does not involve an increase of more than twenty five percent (25%) of the total contract price, and shall then be released only as to such excess increase; and (c) that no provision of this Bond or of any other contract shall be valid which limits to less than one (1) year from the time of the acceptance of the work the right to sue on this Bond for defects in the quality of the work or material not discovered or known to the oblige at the time such work was accepted.

19. This Bond shall be governed in accordance with the laws of the State of Iowa.

20. Modifications to this Bond are as follows:

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EJCDC
ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

Contractor's Application for Payment No.

To (Owner):	Application Period:	Application Date:
	From (Contractor):	Via (Engineer):
Project:	Contract:	
Owner's Contract No.:	Contractor's Project No.:	Engineer's Project No.:

Application For Payment

Change Order Summary

Approved Change Orders		
Number	Additions	Deductions
TOTALS		
NET CHANGE BY CHANGE ORDERS		

1. ORIGINAL CONTRACT PRICE	**$**
2. Net change by Change Orders	**$**
3. Current Contract Price (Line 1 ± 2)	**$**
4. TOTAL COMPLETED AND STORED TO DATE (Column F total on Progress Estimates)	**$**
5. RETAINAGE:	
a. X _____ Work Completed	**$**
b. X _____ Stored Material	**$**
c. Total Retainage (Line 5.a + Line 5.b)	**$**
6. AMOUNT ELIGIBLE TO DATE (Line 4 - Line 5.c)	**$**
7. LESS PREVIOUS PAYMENTS (Line 6 from prior Application)	**$**
8. AMOUNT DUE THIS APPLICATION	**$**
9. BALANCE TO FINISH, PLUS RETAINAGE (Column G total on Progress Estimates + Line 5.c above)	**$**

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:
(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;
(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all Liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such Liens, security interest, or encumbrances); and
(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor Signature

By:	Date:

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is recommended by: _____ _____
(Engineer) (Date)

Payment of: $ _____
(Line 8 or other - attach explanation of the other amount)

is approved by: _____ _____
(Owner) (Date)

MWA Acct. Code: _____

Progress Estimate - Lump Sum Work

Contractor's Application

For (Contract):	Application Number:
Application Period:	Application Date:

			Work Completed		E	F		G
A		B	C	D	Materials Presently Stored (not in C or D)	Total Completed and Stored to Date (C + D + E)	% (F / B)	Balance to Finish (B - F)
Specification Section No.	Description	Scheduled Value ($)	From Previous Application (C+D)	This Period				
	Totals							

Progress Estimate - Unit Price Work

Contractor's Application

For (Contract):								Application Number:			
Application Period:								Application Date:			
A					B	C	D	E	F		
Item		Contract Information				Estimated Quantity Installed	Value of Work Installed to Date	Materials Presently Stored (not in C)	Total Completed and Stored to Date (D + E)	% (F / B)	Balance to Finish (B - F)
Bid Item No.	Description	Item Quantity	Units	Unit Price	Total Value of Item ($)						
	Totals										

Stored Material Summary

Contractor's Application

For (Contract):								Application Number:			
Application Period:								Application Date:			
A		B	C		D		E		F		G
Bid Item No.	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Storage Location	Description of Materials or Equipment Stored	Stored Previously		Amount Stored this Month ($)	Subtotal Amount Completed and Stored to Date (D + E)	Incorporated in Work		Materials Remaining in Storage ($) (D + E - F)
					Date Placed into Storage (Month/Year)	Amount ($)			Date (Month/ Year)	Amount ($)	
				Totals							

Request for Information Form

Contractor's RFI No. _____ Engineer's RFI No. _____

Contract: _____

Contractor: _____

Owner: Metro Waste Authority Owner's Contract No. P-66

Engineer HDR Engineering, Inc. Engineer's Contract No. _____

THIS REQUEST BY:___ cc to:_____
(Name of the Contractor's Representative)

REFERENCE: DIVISION _____ SECTION _____ PLAN SHEET NO. _____

_____

_____

_____

_____

_____

ATTACHMENTS _____

INTERPRETATION BY: _____Date:_____, 20___
(Name of the Engineer's Representative)

_____

_____

_____

_____

_____

ATTACHMENTS_____

The General Conditions specifies that once the Engineer provides a response to a Contractor's RFI, that determination shall be final and binding on the Contractor unless the Contractor delivers to the Owner written notice of a change in the work within a certain period of time of receipt of that determination. See the GCs for further clarification.

cc to: _____

_____

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Field Order No. ___

Project Name:	P-66 Scalehouse Construction	Owner's Project No. (if applicable):	P-66
Project Owner:	Metro Waste Authority	Regulatory Agency Project No. (if applicable):	N/A
HDR Project No.:		Date:	

Attention:
You are hereby directed to promptly execute this Field Order for minor changes in work without changes in Contract Sum or Contract Time.

If you consider that a change in Contract Sum or Contract Time is required, please submit your itemized proposal to HDR immediately and before proceeding with this work. If your proposal is found to be acceptable and in proper order, this Field Order will in that event be superseded by a Change Order.

Reference:

Receipt Acknowledged: General Contractor	By: HDR Engineering, Inc.
Date	Date

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Work Change Direction No. ___

Date of Issuance:		Effective Date:	Immediately Upon Issuance
Owner:	Metro Waste Authority	Owner's Contract No.:	P-66
Contractor:		Contractor's Project No.:	
Engineer:	HDR Engineering, Inc.	Engineer's Project No.:	
Project:	P-66 Scalehouse Construction	Contract Name:	Same as project

Contractor is directed to proceed promptly with the following change(s):

Attachments: None.

Purpose for Work Change Directive:
Directive to proceed promptly with the Work described herein, prior to agreeing to changes on Contract Price and Contract Time, is issued due to: *[check one or both of the following]*

☐ Non-agreement on pricing of proposed change.
☐ Necessity to proceed for schedule or other Project reasons.

Estimated Change in Contract Price and Contract Times (non-binding, preliminary):

Contract Price $ [increase] / [decrease].

Contract Time days [increase] / [decrease].

Basis of estimated change in Contract Price:
☐ Lump Sum ☐ Unit Price
☐ Cost of the Work ☐ Other

RECOMMENDED:	AUTHORIZED BY:	RECEIVED:
By: _____ Engineer (Authorized Signature)	By: _____ Owner (Authorized Signature)	By: _____ Contractor (Authorized Signature)
Title:	Title:	Title:
Date:	Date:	Date:

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Change Proposal Request No. ___

Date of Initiation:		Initiated By:	
Owner:	Metro Waste Authority	Owner's Contract No.:	P-66
Contractor:		Contractor's Project No.:	
Engineer:	HDR Engineering, Inc.	Engineer's Project No.:	
Project:	P-66 Scalehouse Construction	Contract Name:	Same as project

The following change in the contract for this project is proposed. A breakdown of cost shall be attached and no work shall be commenced until authorized by the Owner.

1. Description of the Proposed Change(s):
2.

By: _____

All work shall be in accordance with the terms, stipulations, and conditions of the original Contract Documents. If the work herein provided for is approved by Change Order, the change in Contract Price and Contract Time will be:

Contract Price $ [increase] / [decrease].

Contract Time days [increase] / [decrease].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price

☐ Cost of the Work ☐ Other

Proposed By:	Engineer Recommendation	Owner's Action
Ryan Incorporated Central	☐ Recommend Acceptance	☐ Accepted
	☐ Do Not Recommend Acceptance	☐ Not Accepted
By: Contractor	By: HDR Engineering, Inc.	By: Owner
Date	Date	Date

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial 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 Requirements or the proposed Contract Documents.

2. *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 Engineer 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, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

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.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents. .

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Engineer*—The individual or entity named as such in the Agreement.

21. *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.

22. *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.

23. *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.

24. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

25. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date or by a time prior to Substantial Completion of all the Work.

26. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

27. *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.

28. *Owner*—The individual or entity 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.

29. *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.

30. *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.

31. *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, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

32. *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.

33. *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.

34. *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.

35. *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.

36. *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.

37. *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.

38. *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.

39. *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.

40. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, 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.

41. *Successful Bidder*—The Bidder whose Bid the Owner accepts, and to which the Owner makes an award of contract, subject to stated conditions.

42. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

43. *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.

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, 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.

45. *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.

46. *Unit Price Work*—Work to be paid for on the basis of unit prices.

47. *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.

48. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements 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 Engineer's recommendation of 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 (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

C. *Evidence of Owner’s Insurance*: After receipt of the executed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or otherwise), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully executed counterpart of the Agreement), and one 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 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 10 days after the Effective Date of the Contract (or as otherwise specifically required by the Contract Documents), Contractor shall submit to Engineer 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 any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of 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 sufficient 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.

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 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 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 Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

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. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

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.

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. 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*: 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 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.

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 or not 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).

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 on the thirtieth day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier.

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 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.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

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. 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. abnormal weather conditions;

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 within 30 days of the commencement of the delaying, disrupting, or interfering event.

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 current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

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, 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 Supplementary Conditions identify:

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.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions 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 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.

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 shall, promptly 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 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 Requirements 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, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary 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 of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

a. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

b. locating all Underground Facilities shown or indicated in the Contract Documents as being at the Site;

c. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

d. 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 Supplementary Conditions identify:

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 Supplementary Conditions 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, Owner shall indemnify and hold harmless Contractor, Subcontractors, 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, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.H shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. 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 the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. 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, each in an 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. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the Supplementary Conditions, or other specific provisions of the Contract. Contractor shall also furnish such other bonds as are required by the Supplementary Conditions or other specific provisions of the Contract.

B. All bonds shall be in the form prescribed by the Contract 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. 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.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this Article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or 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 Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII 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), certificates of insurance 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. Owner shall deliver to Contractor, with copies to each named insured and additional insured (as identified in this Article, the Supplementary Conditions, or elsewhere in the Contract), certificates of insurance establishing that Owner has obtained and is maintaining the policies, coverages, and endorsements required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies and endorsements, and documentation of applicable self-insured retentions and deductibles. Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

E. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, shall not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

F. If either party does not purchase or maintain all of 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.

G. 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.

H. 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.

I. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests.

J. 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.

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 in monopolist worker's compensation states).

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, other than to the Work itself, 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.

b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.

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. 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.

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; 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 two 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 10 days prior written notice has been given to Contractor. 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.

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.

6.04 *Owner's Liability Insurance*

A. In addition to the insurance required to be provided by Contractor under Paragraph 6.03, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

B. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

6.05 *Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, 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 Supplementary Conditions or required by Laws and Regulations). This insurance shall:

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions 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 Supplementary Conditions, 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 Supplementary Conditions. 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. *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 10 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.

C. *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.

D. *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.

E. *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.

F. *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.

6.06 *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. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 6.06.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them.

D. 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.

6.07 *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.

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, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

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.

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. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. 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 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, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, or both, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of 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, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. 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. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work

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.

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 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy 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. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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 Supplementary Conditions 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. 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).

F. 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).

G. 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.

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 three submittals. Engineer will record Engineer's time for reviewing a fourth or 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. 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.

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, 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, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission 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.

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.

C. The indemnification obligations of Contractor under Paragraph 7.18.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:

1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or

2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

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 following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. the identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. an itemization of the specific matters to be covered by such authority and responsibility; and

3. the extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work at or adjacent to the Site for Owner, the Owner's employees, any other contractor working for Owner, or any utility owner causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment shall take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract. When applicable, any such equitable adjustment in Contract Price shall be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. 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 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.

C. 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.

D. 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 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 claims, 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 such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement 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 duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

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. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

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.

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. 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 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 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 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.

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 Work involved is not covered by unit prices contained in the Contract Documents, then by a 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 Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on

the basis of 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:

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 11.01.C.2.a and 11.01.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 on the basis of 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 on the basis of 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 30 days) after the start of the event giving rise thereto, or after such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 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 30 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 take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing 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 actually 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.

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. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents; and

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim shall rest with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, or both, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim shall be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*:

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate shall stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process shall resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim

submittal and decision process shall resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action shall be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim shall be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim shall be incorporated in a Change Order to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

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 on the basis of 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 on the basis of 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 on the basis of 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. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others 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.

    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. 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.

    f. 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 the purpose of determining Contractor's fee.

g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

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, expediters, 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 as a whole is performed on the basis of 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 on the basis of 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 on account 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 on account 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.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract 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 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 as a result 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. 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.

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.

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 Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to

cover the same 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, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if 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 prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages 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. If any such acceptance occurs prior to 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 or not 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 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, 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.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work 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, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. 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.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will

include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. 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 Engineer. Progress payments on account 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 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is 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.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that 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.

3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*:

1. Engineer will, within 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; 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 on account 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; or

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.

D. *Payment Becomes Due*:

1. Ten 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 on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account 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 as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final 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.

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 make an inspection of 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.

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 make an inspection of 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. 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 particulars 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. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. 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.

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 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 a particular 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 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 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 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 persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient 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 repeated 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) ten 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.

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 seven 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.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond shall govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate For Convenience*

A. Upon seven 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. 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 fair and reasonable sums for overhead and profit on such Work;

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 on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

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 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 30 days after it is submitted, or (3) Owner fails for 30 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 30 days after it is submitted, or Owner has failed for 30 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. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full; and

2. Disputes between Owner and Contractor concerning the Work or obligations under the Contract Documents, and arising after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this Article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions; or

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

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 particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and 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 in which the Project is located.

18.08 *Headings*

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

SECTION 00 80 00
SUPPLEMENTARY CONDITIONS

1 – DEFINITIONS AND TERMINOLOGY

SC-1.01 Defined Terms

SC-1.01

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

> Geotechnical Baseline Report (GBR) - The interpretive report prepared by or for Owner regarding subsurface conditions at the Site and containing specific baseline geotechnical conditions that may be anticipated or relied upon for bidding and contract administration purposes, subject to the controlling provisions of the Contract, including the GBR's own terms. The GBR is a Contract Document.
>
> Geotechnical Data Report (GDR) - The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner in support of the Geotechnical Baseline Report. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions, comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

SC-1.01.A

Add the following sentence to the end of Paragraph GC-1.01.A:

> "When used in a context consistent with the definition of a listed-defined term, the term shall have a meaning as defined below whether capitalized or italicized or otherwise."

SC-1.01.A.20

Replace paragraph GC-1.01.A.20 with the following paragraph:

> Engineer – The individual or entity named as such in the Agreement with respect to the design of the Project; however with respect to rights, responsibilities and authorities assigned to "Engineer" in the Contract Documents, the word Engineer shall be read as "Engineer and/or Owner's Construction Quality Assurance Consultant." Upon Award of Contract, Owner shall provide a clarification to the Contractor defining (if any) the division of rights, responsibilities and authorities of the Engineer and the Owner's Construction Quality Assurance Consultant.

2 – PRELIMINARY MATTERS

SC-2.04 Preconstruction Conference; Designation of Authorized Representatives

SC-2.04.A Modify paragraph GC-2.06A. by adding the following phrase after the word "started":

"(except with approval of the Owner)"

3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC-3.01 Intent

SC-3.01.F

Add the following new paragraphs immediately after Paragraph 3.01.E:

F. The Specifications may vary in form, format and style. Some Specifications sections are written in varying degrees of streamlined or declarative style and some sections may be relatively narrative by comparison. Omissions of such words and phrases as "the Contractor shall," "in conformity with," "as shown," or "as specified" are intentional in streamlined sections. Omitted words and phrases shall be supplied by inference. Similar types of provisions may appear in various parts of a section or articles within a part depending on the format of the section. The Contractor shall not take advantage of any variation of form, format or style in making claims for extra Work.

G. The cross referencing of Specifications sections under the subparagraph heading "Related Sections include but are not necessarily limited to:" and elsewhere within each Specifications section is provided as an aid and convenience to the Contractor. The Contractor shall not rely on the cross referencing provided and shall be responsible to coordinate the entire Work under the Contract Documents and provide a complete Project whether or not the cross referencing is provided in each section or whether or not the cross referencing is complete.

F. The Construction Documents, and the Project to be constructed in accordance with the Construction Documents, are subject to the provisions and requirements of Iowa Code Chapter 573.

4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.03 Reference Points

SC-4.03.B

Add the following paragraph immediately after Paragraph GC-4.03.A:

B. Contractor shall engage, at Contractor's expense, a registered professional engineer or licensed land surveyor to give Contractor lines and elevations for Contractor's use in constructing the Work. The registered engineer or licensed land surveyor shall furnish to Engineer, through Contractor, a signed plat certifying the location and elevation of the Work indicating ties and closure to reference points established by the Owner and indicated on the Drawings.

SC-4.05.H

Add the following paragraphs immediately after paragraph GC-4.05.G:

H. No extension of the Contract Time will be allowed for additional Work or for claimed delay unless the additional Work contemplated or claimed delay is shown to be on the critical path of the Project's schedule of construction or Contractor can show by critical path method analysis how the additional Work on claimed delay adversely affects the critical path.

I. Time extensions will not be granted for rain, wind, flood, or other natural phenomena of normal intensity for the locality where Work is performed. For purpose of determining extent of delay attributable to unusual weather phenomena, a determination shall be made by comparing the weather for a minimum continuous period of at least one-fourth of the Contract Time involved with the average of the preceding 5-year climatic range during the same time interval based on U.S. Weather Bureau statistics for the locality where the Work is performed.

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

SC-5.03 Subsurface and Physical Conditions

SC-5.03.C

Add the following new paragraphs immediately after Paragraph 5.03.B:

C. Other drawings that were not included with the Bidding Documents are available for examination at the HDR office at 300 East Locust Street, Suite 210 Des Moines, IA 50309 during regular business hours. Those not furnished with the Bidding Documents are available upon request for the cost of reproduction of $0.20 per page plus express shipping.

SC-5.06.A.3

Add the following new subparagraphs immediately after Paragraph 5.06.A.2:

3 Reports and other drawings that were not included with the Bidding Documents are available for examination at the HDR office during regular business hours. Those not furnished with the Bidding Documents are available upon request for the cost of reproduction of $0.20 per page plus express shipping.

6 – BONDS AND INSURANCE

SC-6.02 Insurance—General Provisions

SC-6.02.B.1

Add the following paragraph immediately after Paragraph 6.02.B:

1. Contractor may obtain worker's compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker's compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker's compensation insurance for similar projects by the State of Iowa within the last 12 months.

SC-6.03 Contractor's Insurance

SC 6.03.C

Delete Paragraph 6.03.C in its entirety and replace it with the following:

C. *Commercial General Liability—Forms and Content:* Contractor's commercial liability policy shall be written on a 2007 (or newer) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

SC 6.03.C.1.a

Delete Paragraph 6.03.C.1.a in its entirety and replace the same with the following:

a. Such insurance shall be maintained for 10 years after final payment.

SC 6.03.C.9

Add the following paragraph immediately after Paragraph 6.03.C.8:

9. Per Project Aggregate.

SC 6.03.I.3

Delete Paragraph 6.03.I.3 in its entirety and replace it with the following:

3. contain a provision or endorsement that the coverage afforded will not be canceled or renewal refused until at least 30 days prior written notice has been given to Contractor. 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.

SC 6.03.K

Add the following new paragraph immediately after Paragraph 6.03.J:

K. The limits of liability for the insurance required by Paragraph 6.03 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

1. Workers' Compensation, and related coverages under Paragraphs 6.03.A.1 and A.2 of the General Conditions:

State:		Statutory
Federal, if applicable (e.g., Longshoreman's):		Statutory
Jones Act coverage, if applicable:		
Bodily injury by accident, each accident	$	N/A
Bodily injury by disease, aggregate	$	N/A

Employer's Liability:

Bodily injury, each accident	$ 500,000
Bodily injury by disease, each employee	$ 500,000
Bodily injury/disease aggregate	$ 500,000

For work performed in monopolistic states, stop-gap liability coverage shall be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of: $ N/A

Foreign voluntary worker compensation: Statutory

2. Contractor's Commercial General Liability under Paragraphs 6.03.B and 6.03.C of the General Conditions:

General Aggregate	$ 2,000,000
Products - Completed Operations Aggregate	$ 2,000,000
Personal and Advertising Injury	$ 1,000,000
Each Occurrence (Bodily Injury and Property Damage)	$ 1,000,000

3. Automobile Liability under Paragraph 6.03.D. of the General Conditions:

Combined Single Limit of $ 1,000,000

4. Excess or Umbrella Liability:

Per Occurrence	$ 5,000,000
General Aggregate	$ 5,000,000

5. Contractor's Pollution Liability:

Each Occurrence	$ 1,000,000
General Aggregate	$ 3,000,000

☐ If box is checked, Contractor is not required to provide Contractor's Pollution Liability insurance under this Contract

6. Additional Insureds: In addition to Owner and Engineer, include as additional insureds the following: None.

7. Contractor's Professional Liability:

Each Claim	$ 1,000,000
Annual Aggregate	$ 1,000,000

SC-6.05 Property Insurance

SC-6.05.A.14

Add the following to the list of requirements in Paragraph 6.05.A, as a numbered item:

14. be subject to a deductible amount of no more than $25,000 for direct physical loss in any one occurrence.

SC-6.05.A.1.a

Add the following new subparagraph after subparagraph 6.05.A.1:

a. In addition to Owner, Contractor, and all Subcontractors, include as insureds the names of Engineer, Owner's Construction Quality Assurance Consultant and each of their respective subconsultants, who will be identified upon Award of Contract, as their interests may appear, including their respective officers, directors, agents, and employees.

SC-6.05.A.15

Add the following to the list of items in Paragraph 6.05.A, as numbered items:

15. include for the benefit of Owner loss of profits and soft cost coverage including, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus attorneys' fees and engineering or other consultants' fees, if not otherwise covered;

16. include by express endorsement coverage of damage to Contractor's equipment.

7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.01 Supervision and Superintendence

SC-7.01.B

Add the following sentence to the end of Paragraph 7.01.B:

"The Contractor shall identify its representative at the Site that shall have authority to act on behalf of Contractor. All communications given to or received from this representative shall be binding on Contractor."

SC-7.01.C

Add the following new paragraph immediately after Paragraph 7.01.B:

C. Any superintendent or other personnel, who repeatedly fails to follow the Engineer's written or oral orders, directions, instructions, or determinations, shall be subject to removal from the project. Upon the written request of the Owner, the Contractor shall immediately remove such superintendent or other personnel and name a replacement in writing. Noncompliance with the Owner's request to remove and replace personnel at any level shall be grounds for terminating the Contract.

SC-7.02 Labor; Working Hours

SC-7.02.B

Delete Paragraph 7.02 B. in its entirety, and insert the following:

B. In the absence of any Laws or Regulations to the contrary or other stipulations in the Contract Documents, Contractor may perform the Work on holidays, during any or all hours of the day, and on any or all days of the week, at Contractor's sole discretion.

SC-7.02.C

Add the following new paragraph immediately after Paragraph 7.02.B:

C. Contractor shall be responsible for the cost of any overtime pay or other expense incurred by the Owner for Engineer's services (including those of the Resident Project Representative, if any), Owner's

representative, and construction observation services, occasioned by the performance of Work on Saturday, Sunday, any legal holiday, or as overtime on any regular work day.

SC-7.02.C.1

Add the following new subparagraph immediately after Paragraph 7.02.C:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined as exceeding 60 hours of active Work during any given week of construction. The hourly cost of the Resident Project Representative is $120 per hour.

SC-7.03 Services, Materials, and Equipment

SC-7.03.A

Add the following new sentence at the end of paragraph GC-7.03.A:

"All items of standard equipment shall be the latest model at the time of delivery, unless otherwise specified."

SC-7.03.B

Add the following new subparagraphs immediately after Paragraph 7.03.B:

1. Where the Work requires equipment be furnished, due to the lack of standardization of equipment as produced by the various manufacturers, it may become necessary to make minor modifications in the structures, buildings, piping, mechanical work, electrical work, accessories, controls, or other work, to accommodate the particular equipment offered. Contractor's bid price for any equipment offered shall include the cost of making any necessary changes subject to the approval of Engineer.

SC-7.08 Permits

SC-7.08.B

Add a new paragraph immediately after Paragraph 7.08A:

B. In those instances where a certificate of occupancy must be obtained before the Work under this Contract can be occupied and placed into service by Owner, it shall be the responsibility of Contractor to arrange, coordinate, and pay any costs of obtaining said certificate.

SC-7.09 Taxes

SC 7.09.B

Add a new paragraph immediately after Paragraph 7.09.A:

B. Owner is exempt from payment of sales and compensating use taxes of the State of *Iowa* and of cities and counties thereof on all materials to be incorporated into the Work.

1. Owner will furnish the required certificates of tax exemption to Contractor for use in the purchase of supplies and materials to be incorporated into the Work.
2. Owner's exemption does not apply to construction tools, machinery, equipment, or other property purchased by or leased by Contractor, or to supplies or materials not incorporated into the Work.

SC-7.11 Record Documents

SC-7.11.B

Add the following new paragraphs at the end of paragraph 7.11.A:

B. Contractor's licensed land surveyor or registered engineer shall confirm all control points identified on the Contract Documents for record document purposes and for purposes of measurement and payment for unit price items. Contractor's record documents shall include certification, by the Contractor's licensed land surveyor or registered engineer, of the final as-constructed geometry of the Project.

1. Owner, at Owner's discretion, may employ the services of a quality assurance surveyor to check the accuracy of Contractor's survey.
2. In the event there is any discrepancy between Contractor's surveys and Owner's quality assurance surveys, a third independent reconciling survey by a licensed land surveyor, mutually acceptable to both of the Contractor and Owner shall be performed to reconcile the discrepancy. The cost of such additional survey shall be borne by the party whose initial survey is at greater deviation from the reconciling survey.

C. Contractor shall update the onsite record drawings on a weekly basis, or more frequently.

SC-7.12 Safety and Protection

SC-7.12.C Insert the following after the first sentence of Paragraph 7.12.C:

"The following Owner safety programs are applicable to the Site:

1. Metro Waste Authority Safety and Health Rules for Outside Contractors;
2. Metro Waste Authority Contractor Orientation Written Program; and
3. Metro Waste Authority Contractor Safety Declaration."

SC-7.16 Shop Drawings, Samples and Other Submittals

SC-7.16.A.3

Add the following new sentence and paragraph at the end of paragraph 7.16.A.3:

", otherwise, Contractor will not be relieved of the responsibility of executing the Work in accordance with the Contract Documents, even though such Shop Drawings or Samples have been otherwise reviewed.

a. If a Shop Drawing or Sample, as submitted, indicates a variation from the Contract requirements as set forth in the Contract Documents and Engineer finds same to be in the interest of Owner and to be so minor as not to involve a change in the Contract Price or time for performance, Engineer may approve the Shop Drawings or Samples; provided however, such departure is slight in nature and does not affect the design concept of the Work."

Add the following paragraphs at the end of paragraph GC-7.16.A.3:

4. Contractor shall submit all Shop Drawings and Samples sufficiently in advance of construction requirements to allow ample time for checking, correcting, resubmitting and rechecking and to avoid any delay in progress of the Work.
5. Shop Drawings and Sample submittals not conforming to requirements of the Contract Documents will be returned to Contractor without action for resubmittal and the resulting delay shall be entirely the responsibility of Contractor.

SC-7.16.D.1

Modify the first sentence of GC-7.16.D.1 by deleting the following word after the word "provide":

"timely"

SC-7.16.E.4

Add the following paragraph immediately after paragraph GC-6.17.E.3:

4. Engineer's check and review of Shop Drawings and Samples, standard specifications and descriptive literature submitted by Contractor will be only for general conformance with design concept, except as otherwise provided, and shall not be construed as:
   a. permitting any departure from the Contract requirements;
   b. relieving Contractor of the responsibility for any error in details, dimensions or otherwise that may exist in such submittals;

c. constituting a blanket approval of dimensions, quantities, or details of the material or equipment shown; or

d. approving departures from additional details or instructions previously furnished by Engineer. Such check or review shall not relieve Contractor of the full responsibility of meeting all of the requirements of the Contract Documents.

SC-7.18 Indemnification

SC 7.18.A

Amend Paragraph 7.18.A by deleting the following:

"negligent".

9 – OWNER'S RESPONSIBILITIES

SC-9.07 Change Orders

SC-9.07.A

Modify Paragraph GC-9.07A. by adding the following sentence at the end of the first sentence:

Contractor shall, at Contractor's own expense, provide help and other assistance as may be required for making measurements of Unit Price Work.

10 – ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 Project Representative

SC-10.03

Add the following paragraphs immediately after Paragraph 10.03.A:

B. The Resident Project Representative (RPR) will be Engineer's representative at the Site, will act as directed by and under the supervision of Engineer, and will confer with Engineer regarding RPR's actions.

1. General: RPR's dealings in matters pertaining to the Work in general shall be with Engineer and Contractor. RPR's dealings with Subcontractors shall only be through or with the full knowledge and approval of Contractor. RPR shall generally communicate with Owner only with the knowledge of and under the direction of Engineer.

2. Schedules: Review the progress schedule, schedule of Shop Drawing and Sample submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

3. Conferences and Meetings: Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings, and prepare documentation of such meetings as requested by Engineer.

4. Liaison:

   a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.

   c. Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.

5. Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed.

6. Shop Drawings and Samples:

   a. Record date of receipt of Samples and Contractor-approved Shop Drawings.

   b. Receive Samples which are furnished at the Site by Contractor, and notify Engineer of availability of Samples for examination.

   c. Advise Engineer and Contractor of the commencement of any portion of the Work requiring a Shop Drawing or Sample submittal for which RPR believes that the submittal has not been approved by Engineer.

7. Review of Work and Rejection of Defective Work:

   a. Conduct on-Site observations of Contractor's work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.

   b. Report to Engineer whenever RPR believes that any part of Contractor's work in progress is defective, will not produce a completed Project that conforms generally to the Contract Documents, or will imperil the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of that part of work in progress that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

8. Inspections, Tests, and System Start-ups:

   a. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.

9. Records:

   a. Maintain records for use in preparing Project documentation.

10. Reports:

   a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule.

11. Payment Requests: Assist the Engineer in the review of applications for payment with Contractor for the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

12. Certificates, Operation and Maintenance Manuals: During the course of the Work, verify that materials and equipment certificates, operation and maintenance manuals and other data required by the Contract Documents to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have these documents delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

13. Completion:

   a. Participate in Engineer's visits to the Site to determine Substantial Completion, assist in the determination of Substantial Completion and the preparation of a punch list of items to be completed or corrected.

   b. Participate in Engineer's final visit to the Site to determine completion of the Work, in the company of Owner and Contractor, and in preparation of a final punch list of items to be completed and deficiencies to be remedied.

   c. Observe whether all items on the final list have been completed or corrected and make recommendations to Engineer concerning acceptance and issuance of the notice of acceptability of the work.

C. The RPR shall not:

1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, or any failure of the Contractor to comply with Laws and Regulations applicable to the Contractor's performance of the work.

5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.

7. Accept Shop Drawing or Sample submittals from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part.

13 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-13.03 Unit Price Work

SC-13.03.B

Add the following sentence immediately at the end of Paragraph 13.03.B:

"Progress estimates serve only as basis for partial payments. The Engineer may revise progress estimates and/or quantities any time before final acceptance. If the Engineer deems it proper to do so, changes may be made in progress estimates and in the final estimate."

SC-13.03.C.

Add the following sentence immediately at the end of Paragraph 13.03.C:

"Work described in the Contract Documents, or reasonably inferred as required for a functionally complete installation, but not identified in the listing of unit price items, shall be considered incidental to unit price work listed and the cost of incidental work included as a part of the unit price."

SC 13.03.E

Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:

1. if the extended price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 20 percent from the estimated quantity of such item indicated in the Agreement; and

2. if there is no corresponding adjustment with respect to any other item of Work; and

3. if Contractor believes that Contractor has incurred additional expense as a result thereof, Contractor may submit a Change Proposal, or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, Owner may make a Claim, seeking an adjustment in the Contract Price.

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

SC-15.01 Progress Payments

SC-15.01.B.1

Delete the first sentence of Paragraph 15.01.B.1 in its entirety and insert the following in its place:

1. By the 10th day of each month, Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

SC-15.01.D

Delete Paragraph 15.01.D in its entirety and insert the following in its place:

D. 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.

SC-15.03 Substantial Completion

SC 15.03.B.1

Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, shall be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under Article 15.

SC-15.06 Final Payment

SC-15.06.D.

Delete Paragraph 15.06.D in its entirety and insert the following in its place:

D. *Payment Becomes Due*: The Engineer shall present to Owner the final Application for Payment and accompanying documentation. Subject to the provisions of Iowa Code Chapter 573 and as hereinafter provided in this Paragraph 15.06.D, 30 days after the last to occur of (i) the completion of the Work and (ii) final acceptance of the Work by Owner, the amount recommended by Engineer in the final Application for Payment (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages, set-offs allowed under the provisions above with respect to progress payments, set-offs for claims on file with Owner for material and/or labor in accordance with Iowa Code Chapter 573, as more specifically addressed in Paragraph 15.06.D.1 below) will become due and shall be paid by Owner to Contractor.

   1. *Claims for Materials and/or Labor*. In accordance with Iowa Code Chapter 573, if at the end of the above-referenced 30-day period claims are on file with the Owner for materials and/or labor, Owner shall continue to retain from the unpaid funds a sum equal to double the total amount of all claims on file. The remaining balance of the unpaid funds shall be released and paid to Contractor.

   2. *Interest.*

      a. In accordance with Iowa Code Chapter 573 and subject to the provisions therein, failure to make payment of any amount due to Contractor within 50 days after the last to occur of (i) the completion of the Work and (ii) final acceptance of the Work by Owner, shall cause interest to accrue on the amount unpaid to the benefit of the unpaid party.

      b. Interest shall accrue during the period commencing the 31st day following the last to occur of (i) the completion of the Work and (ii) final acceptance of the Work by Owner, and ending on the date of payment.

      c. The rate of interest shall be determined by the period of time during which interest accrues, and shall be the same as the rate of interest that is in effect under Iowa Code Section 12C.6, as of the day interest begins to accrue, for a deposit of public funds for a comparable period of time. Except as provided in Iowa Code Sections 573.12 and 573.16, interest shall not

accrue on funds retained by Owner to satisfy claims for material and/or labor on file with Owner.

3. *Exception*. In accordance with Iowa Code Chapter 573, no part of the unpaid fund due to Contractor shall be retained, as provided in Iowa Code Chapter 573, on claims for materials furnished, other than materials ordered by the Contractor or Contractor's authorized agent, unless such claims are supported by a certified statement that the Contractor had been notified within 30 days after the materials were furnished or by itemized invoices rendered to Contractor during the progress of the Work, of the amount, kind and value of the material furnished.

SC-15.07 Waiver of Claims

SC-15.07.B.

Delete Paragraph 15.07.B in its entirety and insert the following in its place:

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

16 – SUSPENSION OF WORK AND TERMINATION

SC-16.02 Owner May Terminate for Cause

SC-16.02.H.

Add the following paragraphs immediately after paragraph 16.02.G:

H. Neither Owner, Engineer, nor any of their respective consultants, agents, officers, directors or employees shall be in any way liable or accountable to Contractor or Surety for the method by which the completion of the Work, or any portion thereof, may be accomplished or for the price paid therefore.

I. Maintenance of the Work shall continue to be Contractor's and Surety's responsibilities as provided for in the bond requirements of the Contract Documents or any special guarantees provided for under the Contract Documents or any other obligations otherwise prescribed by law.

17 – FINAL RESOLUTION OF DISPUTES

SC-17.02 Arbitration

SC-17.02

Add the following new paragraph immediately after Paragraph 17.01.

17.02 *Arbitration*

A. All disputes arising under this Article shall be resolved through arbitration. This agreement to arbitrate and any other agreement or consent to arbitrate entered into will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. Each party to the Contract Documents may initiate arbitration by serving a written notice upon the adverse party(s) stating as simply as possible the points of difference between the parties and stating an intent to initiate arbitration procedures. A copy of such written notice shall be sent to the Engineer at the same time. The written notice shall be deemed initiation of arbitration procedures. The demand for arbitration will be made within the specific time required in this Article, or if no specified time is applicable within a reasonable time after the matter in question has arisen. In no event shall any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. Within ten (10) days thereafter, the parties shall meet and select an arbitrator. If the parties cannot agree on an arbitrator, Contractor shall have the right to select an arbitrator from a list of five (5) arbitrators submitted by Owner. Each of the five arbitrators submitted shall be a retired Iowa district

court judge or Iowa appellate court justice. The arbitration hearing shall be held within thirty (30) days of the selection of the arbitrator. The hearing shall be conducted informally.

D. No arbitration arising out of or relating to the Contract shall include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:

1. the inclusion of such other individual or entity is necessary if complete relief is to be afforded among those who are already parties to the arbitration; and

2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration and which will arise in such proceedings.

E. The decision shall be reduced to writing and submitted in writing and the determination so made shall be binding upon the parties and shall form the basis for future guidance of all parties on the issues so resolved. The award rendered by the arbitrator(s) shall be consistent with the agreement of the parties and include a concise breakdown of the award, and a written explanation of the award specifically citing the Contract provisions deemed applicable and relied on in making the award.

F. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.

G. The fees and expenses of the arbitrators and any arbitration service shall be shared equally by Owner and Contractor. Each party shall pay for its own witness costs.

H. The arbitration shall be conducted under the Iowa Rules of Civil Procedure.

SC-17.03 Attorneys' Fees

SC-17.03

Add the following new paragraph immediately after Paragraph 17.02:

2. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.

END OF SECTION

DIVISION 01

GENERAL REQUIREMENTS

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SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. References.
2. Specification Formats and Conventions.
3. Work Covered by the Contract Documents.
4. Coordination with Existing Operations.
5. Work Sequence.
6. Use of Premises.
7. Work by Others.
8. Future Work.
9. Owner-Furnished Products.
10. Partial Owner Occupancy.
11. Project Utility Sources.
12. Miscellaneous Provisions.

B. Project Identification:

1. Project Location:
   a. Metro Park West Landfill, 2499 337th Street, Perry, Iowa.
2. Owner: Metro Waste Authority.
3. Work will be performed under the following Prime Contract: Contract P-66 – MPW Scalehouse Construction.

1.2 REFERENCES

A. Definitions:

1. Basic Contract definitions and terminology are included in the General Conditions and Supplementary Conditions of the Contract.
2. The term "approved," when used to convey Engineer's action on Contractor's submittals, applications, and requests, is limited to Engineer's duties and responsibilities as stated in the General Conditions of the Contract.
3. The term "regulations" includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.

B. Industry Standards:

1. 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.
2. Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
3. If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement.
4. The quantity or quality level shown or specified shall be 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.

5. Each Section of the Specifications generally includes a list of reference standards normally referred to in that respective Section. The purpose of this list is to furnish the Contractor with a list of standards normally used for outlining the quality control desired on the project. The lists are not intended to be complete or all inclusive, but only a general reference of standards that are regularly referred to.
6. Each entity engaged in construction on the Project shall be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where copies of standards are needed to perform a required construction activity, obtain copies directly from the publication source and make them available on request.

1.3 SPECIFICATION FORMATS AND CONVENTIONS

A. The Specifications are organized into Divisions and Sections using the 48 Division Format and CSI's "MasterFormat" numbering system.

B. The Specifications use section numbers and titles to help cross-referencing in the Contract Documents. Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of sections in the Contract Documents.

1.4 WORK COVERED BY THE CONTRACT DOCUMENTS

A. Project Identification: P-66 – MPW Scalehouse Construction.

B. The Work of this Contract under the Base Bid generally includes the following:

1. Scalehouse Construction:
    a. Site preparation, stripping vegetation, clearing, and grubbing.
    b. General earthwork including soil excavation and processing, trenching, backfilling, embankment, and compacting.
    c. Soil stockpiling (temporary and permanent, grading).
    d. Excavation and placement of structural fill to reach Base Grades.
    e. Granular Fill.
    f. Coarse aggregate.
    g. Concrete.
    h. Building with all finishes, appliances, systems, fittings, and appurtenances.
    i. Electrical and septic system.
    j. Water line connection.
    k. Erosion controls, storm water pollution prevention, stormwater, groundwater, and leachate management.
    l. Fencing and gates.
    m. Miscellaneous structures and appurtenances.
    n. Contractor’s Health and Safety Plan development and implementation.
    o. Traffic and access controls.
    p. Closeout documentation.
    q. Others: See Drawings and Specifications.
2. Alternate Items:
    a. Solar Panel Installation:
        1) Min. 18-kW panel supply and installation with brackets, wiring, panels, fitting.
    b. Battery Installation:
        1) Min. 13.5-kWh battery supply and installation, Powerwall 3 or approved similar.

1.5 COORDINATION WITH EXISTING OPERATIONS

A. Site Access:

1. Existing site access roads shown on the Drawings shall not be obstructed by Contractor or Work unless specifically indicated on the Drawings.
2. Where roadway crossings are indicated, plan and sequence work to provide Owner uninterrupted use of the existing roadways.
3. Where designated access roads to specific construction areas are not shown on the Drawings, Contractor shall coordinate planned access routes with Owner and Engineer at the pre-construction conference.
4. Mark, rope off, barricade or otherwise protect all work in progress.

B. Drainage:

1. Where earthwork disturbs existing drainage patterns, plan work to ensure continuous proper drainage.

C. Vegetation:

1. Do not disturb vegetation outside the designated limits of construction.
2. Restore all disturbed vegetation to pre-construction conditions.

1.6 WORK SEQUENCE

A. Work Plan:

1. Contractor shall submit a Work Plan including project schedules, sequencing and other conditions and procedures to the Owner and Engineer and obtain such approvals a minimum of 2 weeks prior to beginning to undertake the Work.

B. Work will require sequencing priorities to include, but not necessarily limited to:

1. Scalehouse shell construction shall be priority.
2. Installation of grassing and erosion stabilization materials shall be established based on specified timeframes for seeding.

C. Roadways:

1. Where work is completed during active site hours on other Access Roads and has the potential to restrict traffic flow, plan Work to ensure a minimum of one lane of roadway shall remain open to traffic at all times.
2. Maintain a minimum of one lane of access at all times for Owner soil haul roads.
3. Where Work has the potential to restrict or obstruct roadways:
    a. Submit traffic control plan where crossing or excavation of existing roads is anticipated.
        1) The plan shall show how the disruption to the road will be minimized, and how the duration of the disruption will be minimized.
        2) Obtain Owner and Engineer approval of the plan prior to this work.
    b. Provide services of flagman and barricades at all one-lane access roadway locations, or as necessary during Owner's ongoing operating hours, designed as open for public use below.
        1) Flagman, signage and appropriate barricades will be a necessary part of any impacts or temporary obstructions of Main Access Roads during the hours stipulated above.

D. See Section 01 35 05 on leachate handling.

1.7 USE OF PREMISES

A. Contractor shall have use of the Owner’s premises within the designated limits of construction for construction operations, including use of the Project Site, as allowed by law, ordinances, permits, easement agreements and the Contract Documents, except as noted herein.

B. Contractor's use of premises is limited by Owner's ongoing operations, right to perform work or to retain other contractors on portions of the Project.

1. Owner also anticipates using existing soil borrow operations east of the lined landfill area. As such Contractor should anticipate requiring coordination of traffic with Owner earthwork equipment for safe operation.

C. Hours of Site Access:

1. The Site is open for public use as follows.
   a. Monday-Friday: 8:00 A.M. – 4:00 P.M.
   b. Saturday: Closed except for the first Saturday of every month: 9:00 A.M. – 12:00 P.M.
      1) 8:00 A.M. – 1:00 P.M. (November 1 – March 31).
   c. Sunday: Closed.
2. The Site is closed on the following holidays:
   a. Memorial Day.
   b. Independence Day.
   c. Labor Day.
   d. Thanksgiving Day.
   e. Christmas Day.
3. Contractor and all subcontractors and suppliers shall enter and exit through the main facility gate and stop at scale office to notify attendant upon entering.
4. If access is required beyond the public use hours, Contractor must inform the Owner's designated representative of the required hours of access and must make arrangements with the Owner to obtain such access. Contractor shall obtain prior written permission from the Owner for performing construction activities between the hours of 9:00 P.M. and 5:00 A.M. Monday – Saturday, Sunday operations, and holiday operations. Permission for site access beyond the public use hours will be at the Owner's option.
5. If Contractor is present on-site during non-public use hours, the site must be continually maintained secure from unauthorized access.
6. Contractor shall maintain a daily employee roster for all employees on-site and the daily roster shall be posted at the field office.

D. The Project Site is limited to boundaries indicated in the Contract Documents.

E. Provide protection and safekeeping of material and products stored on or off the premises.

F. Move any stored material or products that interfere with operations of Owner or other Contractors.

1.8 WORK BY OTHERS

A. Owner may perform certain construction operations which will be conducted at the Project Site simultaneously with Work under this Contract. The construction operations performed by the Owner and others include the following:

1. Earthwork and excavation for ongoing soil needed to undertake the operation of the landfill.
2. Ongoing operation of the existing landfill gas collection and control system, groundwater control system, leachate loadout area, and leachate evaporation system.

B. Cooperate fully with separate contractors and/or the Owner so work by others may be carried out smoothly, without interfering with or delaying work under this Contract.

1. Owner will endeavor to dictate construction sequences that minimize impacts to Work under this Contract.
2. Cooperate with other contractors or consultants, hired by the Owner, to allow access to areas required for their performance of work.
   a. Communicate with others performing work to avoid conflicts and identify areas of access.

b. If conflicts are anticipated or identified immediately bring these to the attention of the Owner and Engineer's Resident Project Representative.

1.9 PROJECT UTILITY SOURCES

A. Metro Park West:

1. Electrical: Midland Power Cooperative.
2. Water: Xenia Rural Water District.

1.10 MISCELLANEOUS PROVISIONS

A. Contractor shall be responsible for negotiations of any waivers or alternate arrangements required to enable transportation of materials to the site.

B. Maintain conditions of existing access and haul roads on the site and adjacent facilities such that access is not hindered as the result of construction related activities or deterioration.

C. Contractor shall remove all wind or weather related litter (solid waste) that enters the project area at no additional cost to the Owner and shall ensure such materials are not incorporated into the Work.

D. The Contractor should anticipate up to five (5) days when the volume of wind or weather-related litter will prevent construction. Such days are defined in this paragraph. No extension of the number of calendar days for completion will be granted for the first five (5) such events. Such events must be documented and reported to the Engineer and the Owner immediately following the event. If the volume of windblown litter is such that a five person crew of the Contractor's employ cannot remove such material from the Work area in three hours the Owner will, upon the Contractor's request, remove such material and grant an extension of the number of calendar days for completion provided that such days exceed the five days stated above and provided these events and level of clean-up are properly documented and reported.

E. Contractor shall remove and replace existing fences within or adjacent to the Limits of Construction as construction needs dictate. If necessary, Contractor shall provide temporary lockable gate or other means to allow the site to be secured when Contractor is not present on site. Minimize time when litter fence is removed to minimize potential off-site litter problems. Restore or replace all removed fence to like new condition if removed or damaged during construction. Assist with clean-up of off-site litter to satisfaction of Owner when litter fence is removed.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

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SECTION 01 11 20
JOB CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Project phasing requirements.
2. Job conditions.
3. Site specific health and safety plan.
4. Attachments:
   a. A - Contractor's Safety Rules.
   b. B - Contractor Orientation.
   c. C - Contractor Safety Declaration.

1.2 SUBMITTALS

A. Miscellaneous Submittals:

1. Project schedule.
2. Site specific health and safety plan (HASP).

1.3 ORDER OF CONSTRUCTION AND CONSTRUCTION SCHEDULE

A. Construction operations will be scheduled to allow the Owner uninterrupted operation of existing adjacent facilities.

1. Coordinate connections with existing work to ensure timely completion of interfaced items.

B. At no time shall Contractor or his employees modify operation of the existing facilities or start construction modifications without approval of the Owner except in emergency to prevent or minimize damage.

C. Within 15 days after award of Contract, submit for approval a Gantt Bar chart baseline schedule.

1. Account for schedule of Subcontractors and Suppliers.
2. Include proper phasing and sequence of construction, various crafts, purchasing time, Shop Drawing approval, material delivery, equipment fabrication, start-up, demonstration, and similar time consuming factors.
   a. Application software: Microsoft Project, or equal.
3. Show the order and interdependence of activities.
   a. The start of an activity shall be dependent on the completion of a preceding activity(ies), with Notice to Proceed being the initial activity.
   b. Divide activities if necessary, such that the maximum duration of any list activity is 20 days.

D. Evaluate schedule no less than monthly and as required elsewhere in Contract Documents:

1. Update, correct and submit to Engineer with pay application to show rescheduling necessary to reflect true job conditions.
2. When shortening of various time intervals is necessary to correct for behind schedule conditions, indicate actions to implement to accomplish work in shorter duration.
3. Information shall be submitted to Engineer in writing with revised schedule.

E. If Contractor does not take necessary action to accomplish work according to schedule, Contractor may be ordered by Owner in writing to take necessary and timely action to improve work progress.

1. Owner may require increased work forces, extra equipment, extra shifts or other action as necessary.
2. Should Contractor refuse or neglect to take such action authorized, under provisions of this contract, Owner may take necessary actions including, but not necessarily limited to, withholding of payment and termination of Contract.

F. Provide two-week look-ahead schedules every two (2) weeks and at each construction progress meeting or pre-installation conference.

1.4 PROJECT/SITE CONDITIONS

A. The project site is adjacent to active solid waste disposal areas regulated by the State of Iowa.

1. Contractor shall take appropriate measures and employ the use of appropriate equipment to conduct construction operations in a safe manner that takes into account the types of waste and the by-products thereof that could be present.
   a. By-products may include but are not necessarily limited to: Solid waste, landfill gases, and leachates.
2. Remove solid waste encountered as a result of weather events and dispose of at the landfill active face, and as directed by MWA, by the end of each workday.
   a. Contractor will not be paid for removal of weather related solid waste.

B. Designated Soil Borrow Areas:
1. Soil borrow area is shared with landfill operations and located to the south of the project area onsite.
   a. The current landfill soil borrow areas are anticipated to be used for Owner soil requirements for landfill operations.
   b. The haul route to and from the stockpile area is incidental to this project. Route shall be limited to a southern route determined in coordination with the Owner (not through farm field). Contractor shall repair any damage caused by construction to existing roads used.

C. Health and Safety Plan (HASP):

1. Contractor shall employ the services of a Certified Safety Professional or Certified Industrial Hygienist to:
   a. Evaluate the potential site conditions.
   b. Develop a site specific HASP following the requirements of 29-CFR 1910.120, 29-CFR 1910.146, and the documents in Attachment A as required.
      1) Such plan shall include appropriate measures for confined space entry and fall protection as project conditions warrant.
   c. The Contractor’s HASP shall be kept on file at the Contractor’s field office and made available to the Owner prior to start of construction.
   d. The Contractor’s HASP shall include, at a minimum, the following information:
      1) Project organization chart showing Contractor’s Site Safety Officer.
      2) Summary of the health monitoring program.
      3) Summary of the respiratory protection and site monitoring program.
      4) Summary of protective clothing required.
      5) Summary of decontamination procedures.
      6) List of employees that have completed health and safety training and certificates received.
      7) Description of personnel and visitor access and egress controls.
   e. The Contractor shall be solely responsible for methods and precautions taken while performing work on the project sites to ensure the health and safety of their personnel and of other persons and operations resulting from work on this project.
   f. A Certified Safety Professional shall be certified by the Board of Certified Safety Professionals (BCSPs).

2. Contractor shall complete all work involving the intrusion into existing waste, any confined excavations (such as trenches), and exposure to waste byproducts in conformance with the health and safety requirements stipulated in the Contract Documents and as applicable to the specific situations.
3. Personal Protective Equipment:
    a. Determination of the appropriate level of personal protective equipment and procedures shall be made as a result of initial site survey, review of existing data, and a continued safety and health monitoring program performed by the Contractor's site Safety Representative for the project.
    b. All Owner guidelines, rules and requirements shall be followed; see Attachment A.

D. Special Considerations:

1. Smoking shall not be permitted within the limits of the Metro Park West property.
2. Possible presence of harmful or dangerous substances:
    a. Construction of this Project will require special precautions because of the conditions that exist in a landfill environment. These conditions include but are not limited to: the possible presence of potentially explosive and harmful gases resulting from decomposition of organic and other substances; the presence of leachate which is a liquid which emanates from a landfill and which contains dissolved, suspended, and or microbial contaminants from the solid waste deposits. Contact with this liquid may be harmful to human life.
    b. The Contractor is advised that landfill gases including varying concentrations of methane and hydrogen sulfide gas are known to be present within the landfill.
        1) Such gases are explosive in certain concentrations and also represent a hazard to life under certain conditions including but not limited to confined areas such as leachate lines and tanks, manholes, trenches, and buildings.
        2) Because of these gaseous conditions, the Contractor shall provide any monitoring required to determine the presence, composition, and concentration of gases.
    c. The Contractor is also advised that leachate may be present in unknown quantities within the limits of the site.
        1) Laboratory analysis of leachate samples indicates the presence of low concentrations of volatile organic compounds including acetone, benzene, toluene, and methyl ethyl ketone. pH of the leachate generally ranges from 6 to 7 units.
        2) The Contractor shall be responsible for determining the presence of any potential hazards of any leachate encountered and shall be responsible for implementing safety measures as are appropriate.
            a) These measures may include, but shall not be limited to: protective clothing, special breathing apparatus, and explosion proofing and non-sparking equipment.

PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

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Metro Waste Authority

Contractor's Safety Rules

Metro Park East Landfill
Metro Park West Landfill
Metro Compost Center
Metro Central Transfer Station
Metro Northwest Transfer Station
Metro Hazardous Waste Drop Off
Administrative Office

Revised: March, 2020

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Metro Waste Authority Safety and Health Rules for Outside Contractors

All federal, state, and local safety and health regulations and all Metro Waste Authority safety and health rules must be observed by the employees of outside contractors. Contractor supervisors shall ensure that all of their employees are aware of and comply with the rules and regulations.

Contractors will abide by all posted speed limits, safety rules, and regulations.

VIOLATORS WILL NOT BE PERMITTED TO WORK AT METRO WASTE AUTHORITY FACILITIES.

I. SMOKING
No smoking is permitted in buildings, or on the premises of any MWA facility except in the designated smoking areas. These areas are posted on site. There is no smoking anywhere on Metro Hazardous Waste Drop Off grounds.

II. SAFETY PERMITS/CERTIFACATIONS Safety permits AND/OR program/training certifications must be obtained for the following operations BEFORE work begins:

A: Lockout/Tag-out Procedures required for work on any equipment that could cause injuries if started accidentally.

B: Confined Space Entry Permit:

If confined space entry is anticipated, submittal of the contractor's and/or subcontractors confined space entry program will be required before any work is initiated. The confined space program will detail how confined spaces are determined, tested, and entered.

C: Hot Work Permit:

Required for all open flame or spark producing activities on site.

D: General Industry Walking-Working Surfaces and Fall Protection Standards:

Submittal of the contractor's and/or subcontractor's documentation for Walking-Working Surfaces and Fall Protection program employee training will be required before any work is initiated.

E: Other Permits:

May be required for special procedures or unusual work conditions. Your MWA contact person will coordinate permit requests for the specific area where the work is being performed.

III. HOUSEKEEPING
Work areas must be cleaned and all debris disposed of at least daily. Equipment and supplies must be stored neatly. Aisles, passageways, roadways, fire and other emergency equipment access must be kept clear at all times.

IV. SAFETY SUPPLIES AND PERSONAL PROTECTIVE EQUIPMENT
Approved hard hats are required at the working face and where directed. Other PPE may be required depending on the task and activities being performed.

Class II safety vests or clothing are required to be worn when performing activities on or near the working face or when working on or near roadways in and around the site.

Contractors are required to provide their employees with high visibility items when employees are working in the areas outlined above.

Metro Waste Authority does not provide other safety supplies such as gloves, face shields, goggles, fire extinguishers, and protective clothing for outside contractors. Equipment such as ladders, welding equipment, scaffolds, machinery, tools, forklifts, vehicles, etc. are not loaned to outside contractors without prior authorization from management.

Respiratory protection may be required to be worn by employees. If required, contractors must supply their employees with adequate respiratory protection and train them in the proper use of respirators. Metro Waste Authority may request documentation of training including the names of all employees trained and the manufacturer and model of respiratory equipment for which they have been trained to use.

V. EMERGENCY CONDITIONS

In an emergency, contractor employees will follow instructions given by any managerial employee of Metro Waste Authority. In the event of an evacuation or other on site emergency, contractors are asked to meet at the meeting point designated in the ERRAP.

VI. OTHER GENERAL SAFETY RULES

A. Compressed gas cylinders must be transported, stored, and used in an upright position. All cylinders shall be secured by a chain, or equivalent, with protective caps installed during transit and storage. Cylinder valves shall be closed as soon as work is completed. Oxygen cylinders shall be stored a minimum of20 feet from fuel gas (acetylene, hydrogen, etc.) cylinders when not on the welding cart.

B. When overhead work is necessary, precautions must be taken to prevent fall of persons and materials. The area underneath the work operation shall be roped off and labeled with appropriate warning signs.

C. Flammable liquids shall be stored in and dispensed from approved containers.

D. Ladders must be in good condition and must be made secure near the top.

Scaffolding shall be of substantial construction with guardrails and toe boards installed.

E. Posted traffic control signs must be obeyed at all times and vehicles must be kept in safe operation condition

F. Posted safety signs must be obeyed and observed at all times.

G. Do not shut off or make connections to electric, gas, air, water, or process lines without the prior authorization of Metro Waste Authority managerial personnel.

H. Safety barricades must be put in place at open man holes, floor holes, catch basins, and excavations. Appropriate lights must be installed if holes are to be left open after daylight hours.

I. Firearms and weapons are not permitted on Metro Waste Authority prope1iy for any reason nor are alcoholic beverages or drugs. Violation of these rules will be grounds for immediate expulsion from the facility.

J. SDS Sheet must be provided to Metro Waste Authority personnel before any product is used at the facility.

Metro Waste Authority

Contractor Orientation

Metro Park East Landfill
Metro Park West Landfill
Metro Compost Center
Metro Central Transfer Station
Metro Northwest Transfer Station
Metro Hazardous Waste Drop Off
Administrative Office

Revised 11/01/2019

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Metro Waste Authority Contractor Orientation Written Program

Metro Waste Authority policy mandates the requirement to provide an orientation to all project contractors. OSHA's Right to Know and Lock-out/Tag-out must also be reviewed as appropriate. The following is a written program developed by Metro Waste Authority which details the provisions of the orientation requirement and clearly defines who requires what type of orientation.

This written program does not address procedural items that a Metro Waste Authority employee overseeing a project would typically review with the Contractor. All contractors will be provided an orientation session **prior to commencement of work**, and documentation will be completed to confirm that this orientation was performed (certification form attached). This orientation will be a one time event, and if necessary repeated if new information is required to be conveyed.

Additionally, be before any work is to be done, contractor will provide Metro Waste Authority with a certificate of insurance with a minimum coverage of $1 million and naming **Metro Waste Authority as additionally insured.**

The following highlights the subject matter to be covered in the **contractor orientation** session:

1. A hand-out and review of Metro Waste Authority's Contractor Safety Rules (attached), with emphasis on the following:
   - The need for adhering to all applicable safety requirements
   - The need for using personal protective equipment when necessary,
   - The need to report any accidents or injuries to Metro Waste Authority personnel
   - Emergency phone numbers
   - Requirements for obtaining permits when necessary.

2. An overview of OSHA's Right to Know program, including an explanation of the potential hazards at the site. The contractor will be informed of the location to obtain the MSDS for all on site products, and be informed of his right to access these at any time.

3. The contractor will be made aware of the facility's Emergency Response & Remedial Action Plan and the procedures to follow in the event of an emergency.

4. If applicable, OSHA's Lock-out/Tag-out, Confined Space Requirements, and Hot Work Permit procedures will be explained.

5. Spill prevention and procedures for spill clean-up, including notification of Metro Waste Authority personnel, will be reviewed for contractors who would be using any petroleum based products on MWA property.

6. A "Contractors Safety Declaration" is required and would need to be signed when any contractor is working on site.

For the purpose of this written program, a contractor is defined as any person hired to perform a particular job task at the facility. A contractor is not a delivery person, a visitor, a customer, or a truck driver delivering or picking up solid waste. The aforementioned would not be subject to the requirements of this written program. Current orientation documentation will be kept in a "Contractor's Orientation File". Retention of documentation will be for a period of three years.

Contractor Safety Orientation Review

1. Hand-Out and Review of Health and Safety Rules - emphasis on the following:

   - Proper permits need to be completed and approved, when necessary.

   - Proper housekeeping, maintaining a neat work area, and removing all materials for the site when project is completed.

- All safety equipment will be supplied by the Contractor. Metro Waste Authority will not supply anything.
- All traffic and site safety signage must be obeyed.
- No drugs, alcohol, or weapons are permitted on MWA property.

2. 911 is the emergency number for all facilities.

3. Any accident or injury must be reported to a Metro Waste Authority manager.

4. OSHA's Right to Know (Hazard Communication) - This program is an OSHA requirement that requires employers to ensure that their employees, including all contractors on site, are aware of any hazards that they may be exposed to in the workplace. The Right to Know program usually deals with potential exposures to chemicals in the workplace. Contractors will be made aware of any types of hazards that they may be working around. Contractors will be made aware of the existence of Safety Data Sheets (SDS) for all of the products used on site. The SDS will provide information on the symptoms and treatment of over exposure to the products. The contractor must be made aware of the location of how to obtain the SDS. The contractor is welcome to obtain a copy of any SDS. They need to request a copy to be made The contractor can at any time request that the SDS be reviewed by MWA should there be a concern about their potential exposure to a product. Should the contractor be directly working around a certain product, a SDS for that product must automatically be provided to him or her.

5. Emergency Response & Remedial Action Plan (ERRAP) - Contractors will be made aware of the facility's ERRAP. The ERRAP deals with major emergencies that may arise such as fire, or a major accident. Contractors need to know that should there be an emergency, they will be notified by Metro Waste Authority staff and that they should immediately report the emergency meeting area, located in the ERRAP for that facility. Once all employees and contractors are accounted for, they will be able to leave the site should the situation warrant. **All contractors must sign in and out each day at the administrative office of each specific MWA facility. Exceptions to this can be arranged with the appropriate facility's manager**

6. All spills of petroleum products or any chemical needs to be reported to a Metro Waste Authority supervisor immediately. All spills may be subject to reporting to the IDNR within 4 hours of the spill. The contractor should ensure that the spill is contained before leaving the area to report the spill. Metro Waste Authority will issue guidance on the clean-up procedures.

7. OSHA's Lock-out/Tag-out-Contractor's who may have occasion to be repairing equipment on site must follow OHSA's Lock-out/Tag-out program. If the contractor is a contracted mechanic servicing Metro Waste Authority equipment, they should be made aware that there are lock-out/tag-out procedures for each piece of equipment on site. Contracted mechanics must follow these procedures in order to be in compliance with OSHA's requirements.

Metro Waste Authority
CONTRACTOR SAFETY DECLARATION

As the duly authorized and designated representative and agent of _____, hereinafter called "Contractor", I hereby certify and agree for myself and for and on behalf of Contractor that:

* Contractor has received an orientation briefing including, but not limited to, site-specific safety rules, accident/injury reporting, emergency procedures and potential hazards in the Contractor's work area during routine site operations;

* Contractor will instruct all of its agents and employees in the topics covered at the above orientation, before they are allowed to work on-site;

* Contractor has received a written copy of the site-specific and any relevant task-specific safety rules and will ensure that its employees and agents comply with those rules, as well as any applicable federal, state, and local Safety and Health regulations;

* Contractor will provide required personal protective equipment for its employees and agents working on Metro Waste Authority property;

* Contractor employees have received training in appropriate Safety and Health topics (including, but not limited to, confined space awareness, respiratory protection, hearing conservation, hazard communication and equipment operation), in accordance with state and federal OSHA regulations; and

* Contractor performs regularly scheduled maintenance on owned or leased vehicles and equipment, as per state and federal OSHA regulations (20 CFR 1910 and 1926; Known defects will be repaired prior to operation and, as defects become apparent during equipment operations, the equipment will be taken out of service until repairs are made.

This decision is hereby incorporated into the contractual agreement with:

_____Which is dated ____/____/____

_____ ____/____/____
Contractor's Representative Date

_____ ____/____/____
MWA Employee Presenting Orientation Date

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SECTION 01 21 00

ALLOWANCE (LUMP SUM AND UNIT PRICE PROJECTS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provisions for handling Allowance.

1.2 ALLOWANCE

A. Allowance(s) are established to provide the Owner with a method for compensating the Contractor for specific items of Work that are not completely defined in the Contract Documents prior to the award of contract and maybe required to complete the Work.

B. Allowance(s) for minor changes are for the exclusive use of Owner as a result of changed conditions, design refinements, and unanticipated design issues.

1. The Owner will issue a field order or directive to proceed with the work as defined in the Allowance below.
2. The Owner can compensate the Contractor for the work as defined below without issuing a change order as long as the costs are within the Allowance amount stated in the Contract.
3. Owner approval is required prior to the start of the work and/or authorization of progress payments for the Allowance(s).
4. The Owner and Contractor can agree to compensate the Contractor for work covered by the Allowance(s) in one or more of the following methods;
    a. Lump sum payment agreed to prior to beginning the work,
    b. Agreed on unit prices measured against actual installed quantities, and/or
    c. Contractor's actual costs as documented on force account sheets completed daily and approved by the Owner. Overhead and Profit will be compensated through the Contractor's Fee as defined in the Contract Documents.

C. Contractor shall include in the Bid an Allowance equal to 5.0% of the proposed base bid amount.

1. Include Allowance sum on Bid Form on the line provided.
2. The Total Contract Price shall be the sum of the Base Bid and the Allowance.
3. At Project closeout and prior to Final Payment, adjust the final Contract Sum accordingly by Change Order. Amount of the Change Order shall reflect difference between actual costs of all approved Allowance(s) and the Allowance Amount.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 22 00

MEASUREMENT AND PAYMENT (UNIT PRICE CONTRACTS)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Defines how work items are measured and paid for on Unit Price Contracts. These items include unit price, lump sum price, and allowance payment items.
2. In the case of conflict between this Section and the measurement methods specified in the individual Technical Specification Sections, the measurement methods in Technical Specification Sections shall govern.
3. Receive payment for work after it is installed. Payment for material on hand can only be paid for if allowed by the Agreement, the General and/or Special Conditions.
4. Partial payment may be requested for items partially installed when agreed to by the Owner.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.

1.2 UNIT PRICE ITEMS

A. Quantity and measurement estimates stated in the Bid Form are estimates for bidding purposes only. Actual payments shall be based on actual quantities installed, in-place, as measured and/or verified by the Engineer within approved design boundaries.

B. Unless otherwise stated in the Contract Documents, the bid unit prices shall be in effect throughout the contract duration. When the variance between the estimated quantities and the actual installed quantities is more than 25 percent, the Contractor or the Owner may negotiate a change to the Unit Price. That change will be made in accordance with the Change Order process as defined in the Contract Documents.

C. Except as defined above, make no claim, nor receive any compensation, for anticipated profits, loss of profit, damages, or any extra payment due to any difference between the amounts of work actually completed, or materials or equipment furnished, and the estimated quantities.

D. The Owner can only pay for quantities that exceed the estimated quantities so long as the total payments to the Contractor do not exceed the Contract Price. If the added quantities will result in payments that exceed the Contract Price, a Change Order will need to be executed before payment can be made for the added quantities.

E. Assist Engineer by providing necessary equipment, workers, and survey personnel as required to measure quantities.

F. Unless stated in the Contract Documents, measured quantities shall be rounded to the nearest whole integer.

G. Measurement:

1. Measurement for progress payment shall be made by, or approved by, the Engineer based on the actual quantities installed. The actual quantities installed can be adjusted for corrections to previous calculations, incomplete elements or components if agreed to in advance and in writing by the Engineer.
2. Unless otherwise provided for in the Contract Documents, unit price items are all inclusive of all related work, direct and indirect costs, to provide a complete and functional item.

3. The final measurement shall be based on actual installed quantities, jointly measured and agreed to by the Contractor and the Engineer. Quantities can be adjusted (increased or decreased) based on a final calculation of quantities by the Engineer and Contractor.

H. Payment:

1. Progress payments shall be in accordance with the Contract Documents based on estimated quantities installed paid at the bid unit price.
2. The final payment shall be based on actual quantities, fully installed, tested and placed into service, paid at the bid unit price.

1.3 LUMP SUM ITEMS

A. Progress payments for Lump Sum items in the Bid Schedule will be based on the breakdown prepared by the Contractor and approved by the Engineer and Owner before acceptance of the Application for Payment for the Lump Sum item.

B. Lump Sum payment will be for the entire item as specified and as indicated in the Contract Documents. Payment for all bid items indicated as Lump Sums shall include the cost of all labor, materials, equipment and incidentals necessary to furnish, install, clean, test, and place each bid item into operation; including permitting, general conditions, overhead and profit.

1.4 APPLICATION FOR PAYMENT

A. Provide a Summary Sheets and breakdown sheets equivalent to those of EJCDC document C-620, Contractor's Application for Payment forms.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 LUMP SUM BID ITEMS - GENERAL

A. Measurement of lump sum bid items will be based on an estimated percent complete of the various components of the lump sum item established by the Contractor’s Schedule of Values and approved by the Engineer.

3.2 UNIT PRICE ITEMS - GENERAL

A. Measurement of unit price bid items will be based on measured values of the various components of the unit item established by the Contractor’s Schedule of Values and approved by the Engineer.

3.3 ITEM DESCRIPTIONS

A. Bid Items include:

1. Bid Item 101 – Mobilization/Demobilization

a. Measurement and Payment:

1) Lump sum to be paid based on estimated percent complete, up to 60% after mobilization and 40% after demobilization.

b. Includes, but is not limited to:

1) all costs to mobilize to site and demobilize from site for the duration of the project.
2) Permits and project management.
3) All work not included in Bid Item Numbers 102 through 106.

2. Bid Item 102 – Construct Scalehouse

a. Measurement and Payment:

1) Lump sum to be paid based on estimated percent complete.

b. Includes, but is not limited to:

1) Labor, equipment, and materials needed to manage stormwater and groundwater for the duration of the project. Installation and maintenance of silt fence, grading, and dewatering pumping is included in this item.
2) Protection of existing and constructed work as described in Contractor Work Plan by use of erosion and sediment control.
3) Contractor to comply with site SWPPP requirements.
4) Included in this item is all structural fill placement, excavation, hauling, temporary stockpiling, and soils testing associated with the grading shown on the plans. Soil shall be taken from the south borrow area and placed in compacted lifts as part of this item.
5) Contractor to apply for building permit and coordinate inspections with the County and Owner to fully comply with code requirements.
6) Construction of the scalehouse shall include all work shown on the drawings and described in the specifications. This includes, but is not limited to, labor, materials, and equipment to install the following:
    a) All electrical including tie-in at the transformer. Trenching, wiring, conduit, and start-up are all included in this item.
        (1) Furnishing and installing the complete system as specified, in place, fully operational and reliable; operation and maintenance manuals; testing, shop drawings, guaranty & warranty, materials, labor, tools, equipment, training of operators until the Owner assumes responsibility for operation of the facility, incidentals and services (including control system vendor services) necessary to achieve a complete and acceptable installation.
        (2) All electric conduit and wiring.
        (3) All conduit for future communication lines as shown on the drawings. Security, gate arms, kiosk, and camera conduits.
        (4) Coordination with electrical provider on timing of electric removals and installations. No allowances in project schedule shall be made for communications with electrical provider.
    b) All water lines, including tie-in at the hydrant. Excavation, tie-in, piping & fittings, backfill.
    c) Grading, structural fill, concrete foundations.
    d) Building shell
    e) Lighting, HVAC, plumbing.
    f) Counters, cabinets, finishes, paint, appliances.
    g) Furniture that is not built in is not included in this project.
    h) 6’ fencing and gate as shown on project drawings. Labor, equipment, and materials needed to supply and install new dual swing gate and fencing.

3. Bid Item 103 – Construct Septic Field

a. Measurement and Payment:
    1) Square foot of installed septic field, as measured by survey and within design limits.
b. Includes, but is not limited to:
    a) Perc test and test report. Exact design size of septic field may vary based on percolation test results.
    b) Septic permit through County
    c) All septic lines, cleanouts, perc test, and septic field. Excavation, tie-ins, piping, tank and fittings, field installation, and backfill.
    d) All soils testing, permitting, materials, equipment, and installation of septic system.

4. Bid Item 104 – Construct Surfacing at Scalehouse

a. Measurement & Payment:

1) Square foot of installed surfacing, as measured by survey and within design limits.
2) Total quantity may be reduced in coordination with Owner installed surfacing limits.

b. Includes, but is not limited to:
1) Labor, equipment, and materials required to place Mirafi 500x roadway geotextile, 6” compacted base aggregate course - Macadams, and 3” compacted surface course -IDOT Gradation 11, to the limits and grades as shown in the project drawings.
2) Incidental to this item are any temporary stockpiling efforts.

5. Bid Item 105 –Remove and Replace Unsuitable Soils

a. Measurement:
1) Measurement shall be by the volume of unsuitable soil removed and replaced as calculated by survey in AutoCAD Civil 3D 2020, OR as measured by onsite CQA Personnel and agreed upon between CQA Personnel and contractor. Unsuitable soil to be identified and approved for removal by CQA personnel.

b. Payment:
1) Payment will be by the unit price per CY of unsuitable soil that is removed from the design excavation limits.

c. Includes, but is not limited to:
1) Labor, equipment, and materials required for excavating, hauling, and placement of unsuitable (material that cannot pass as structural fill material) in the designated stockpile area. If material is discovered during excavation, Engineer and Owner are to be notified for tracking purposes.
2) Labor, equipment, and materials required for placement of replacement soil in lifts as compacted structural fill.
3) Replacement soil shall be taken from the south borrow area.

6. Bid Item 106 – Seeding Disturbed Area (Install owner supplied amended topsoil. Install Seed, Fertilize, Mulch)

a. Measurement:
1) Measurement shall be by the 3D area installed within the design limits by survey as calculated in AutoCAD Civil 3D 2020.

b. Payment:
1) Payment will be at the unit price per acre of seeding and fertilizing within design limits.

c. Includes, but is not limited to:
1) Labor, equipment, and materials needed for seeding areas disturbed by construction including fertilizing, mulching, and seeding in accordance with specifications.
2) Areas disturbed in excess of 2-ac with this project will be seeded as incidental to this item at no additional cost to the Owner.
3) Included in this item is delivery of a full stand of grass.
a) Areas where vegetation is not established by spring of 2025 shall be reseeded at no cost to the Owner.

7. Bid Item 107 – Allowance

1) See 01 21 00 for more information. This item may not be utilized without prior written approval from the Owner.

8. Bid Item 108 – Solar Panel Installation -18-kW - (ALTERNATE BID ITEM)

a. Owner may select this item as an alternate to add to the base bid.

b. Measurement & Payment:
1) Lump sum to be paid based on estimated percent complete.

c. Includes, but is not limited to:

1) Labor, equipment, and materials required to supply and install an 18-kW solar array on the roof of the new scalehouse building.
2) Include all electrical work needed for a solar array installation and for tying in to the scalehouse electrical system. Include permitting, inspections, installation, and coordination with electrical company for net metering.
3) Tie-in to the electrical system at the transformer switch as shown on the drawings.
    (1) Furnishing and installing the complete system as specified, in place, fully operational and reliable; operation and maintenance manuals; testing, shop drawings, guaranty & warranty, materials, labor, tools, equipment, training of operators until the Owner assumes responsibility for operation of the facility, incidentals and services (including control system vendor services) necessary to achieve a complete and acceptable installation.
    (2) All electric conduit and wiring.
4) Supply and install all brackets and mounting hardware on standing seam roof.
5) Minimum system size to be 18-kW. Panels shall be bi-facial, minimum 365-watts each, with a 25-yr manufacturer's warranty.

9. Bid Item 109 – Powerwall Installation - (ALTERNATE BID ITEM)

a. Owner may select this item as an alternate to add to the base bid and Bid Item 108.
b. Measurement & Payment:
    1) Lump sum to be paid based on estimated percent complete.
c. Includes, but is not limited to:
    1) Labor, equipment, and materials required to supply and install an 13.5-kWh Powerwall.
    2) All electrical work required to install a Powerwall and tie-in to the building and solar array systems, including net metering system. Include additional permitting and inspections needed for powerwall installation.
    3) Tie-in to the electrical system at the transformer switch as shown on the drawings.
        (1) Furnishing and installing the complete system as specified, in place, fully operational and reliable; operation and maintenance manuals; testing, shop drawings, guaranty & warranty, materials, labor, tools, equipment, training of operators until the Owner assumes responsibility for operation of the facility, incidentals and services (including control system vendor services) necessary to achieve a complete and acceptable installation.
        (2) All electric conduit and wiring.
    4) Minimum system size to be 13.5-kW.
    5) Install Powerwall on exterior west wall of building per manufacturer's specifications.
    6) Basis of bid is Powerwall 3. Contractors may propose an alternate similar battery system for Engineer and Owner approval.

END OF SECTION

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SECTION 01 25 13
PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. The procedure for requesting the approval of substitution of a product that is not equivalent to a product which is specified by descriptive or performance criteria or defined by reference to one or more of the following:
    a. Name of manufacturer.
    b. Name of vendor.
    c. Trade name.
    d. Catalog number.
2. Substitutions are not "or-equals."
3. This Specification Section does not apply to Proprietary Specifications.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.

C. Request for Substitution - General:

1. Base all bids on materials, equipment, and procedures specified.
2. Certain types of equipment and kinds of material are described in specifications by means of references to names of manufacturers and vendors, trade names, or catalog numbers.
    a. When this method of specifying is used, it is not intended to exclude from consideration other products bearing other manufacturer's or vendor's names, trade names, or catalog numbers, provided said products are "or-equals," as determined by Engineer.
3. Other types of equipment and kinds of material may be acceptable substitutions under the following conditions:
    a. Or-equals are unavailable due to strike, discontinued production of products meeting specified requirements, or other factors beyond control of Contractor; or,
    b. Contractor proposes a cost and/or time reduction incentive to the Owner after Award of Bid.

1.2 QUALITY ASSURANCE

A. In making request for substitution, Contractor represents:

1. Contractor has investigated proposed product and has determined that it is adequate or superior in all respects to that specified, and that it will perform function for which it is intended.
2. Contractor will provide same guarantee for substitute item as for product specified.
3. Contractor will coordinate installation of accepted substitution into work, to include building or facility modifications if necessary, making such changes as may be required for work to be complete in all respects.

4. Contractor waives all claims for additional costs related to substitution which subsequently arise.
5. Any exceptions to the above shall be clearly stated at the time a request is submitted to consider a substitution.

1.3 DEFINITIONS

A. Product: Manufactured material or equipment.

1.4 PROCEDURE FOR REQUESTING SUBSTITUTION

A. Substitution shall be considered only:
   1. After Award of Contract.
   2. Under the conditions stated herein.

B. Written request through Contractor only.

C. Transmittal Mechanics:
   1. Follow the transmittal mechanics prescribed for Shop Drawings in Specification Section 01 33 00.
      a. Product substitution will be treated in a manner similar to "deviations," as described in Specification Section 01 25 13.
      b. List the letter describing the deviation and justifications on the transmittal form in the space provided under the column with the heading DESCRIPTION.
         1) Include in the transmittal letter, either directly or as a clearly marked attachment, the items listed in Paragraph D below.

D. Transmittal Contents:
   1. Product identification:
      a. Manufacturer's name.
      b. Telephone number and representative contact name.
      c. Specification Section or Drawing reference of originally specified product, including discrete name or tag number assigned to original product in the Contract Documents.
   2. Manufacturer's literature clearly marked to show compliance of proposed product with Contract Documents.
   3. Itemized comparison of original and proposed product addressing product characteristics including but not necessarily limited to:
      a. Size.
      b. Composition or materials of construction.
      c. Weight.
      d. Electrical or mechanical requirements.
   4. Product experience:
      a. Location of past projects utilizing product.
      b. Name and telephone number of persons associated with referenced projects knowledgeable concerning proposed product.
      c. Available field data and reports associated with proposed product.
   5. Data relating to changes in construction schedule.
   6. Data relating to changes in cost.
   7. Samples:

a. At request of Engineer.
b. Full size if requested by Engineer.
c. Held until substantial completion.
d. Engineer not responsible for loss or damage to samples.

1.5 APPROVAL OR REJECTION

A. Written approval or rejection of substitution given by the Engineer.

B. Engineer reserves the right to require proposed product to comply with color and pattern of specified product if necessary to secure design intent.

C. In the event the substitution is approved, the resulting cost and/or time reduction will be documented by Change Order in accordance with the General Conditions.

D. Substitution will be Rejected if:

1. Submittal is not through the Contractor with his stamp of approval.
2. Request is not made in accordance with this Specification Section.
3. In the Engineer's opinion, acceptance will require substantial revision of the original design.
4. In the Engineer's opinion, substitution will not perform adequately the function consistent with the design intent.

E. Contractor shall reimburse Owner for the cost of Engineer's evaluation whether or not substitution is approved.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

EXHIBIT A

Substitution Request Form
(One Item per each Form)

Project:	Date:
Substitution Requestor:	
Contractor:	

Specification Section No:	Paragraph No. (i.e. 2.1.A.1.c):	Specified Item:

Proposed Substitution:

Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.

In the lines provided state differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.

_____
_____
_____

In the lines provided demonstrate how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract
:

_____
_____
_____

In the lines provided, describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?

_____
_____
_____

In the lines provided, describe what effect the proposed substitution has on the Construction Schedule and Contract Time.

_____
_____
_____

In the lines provided, describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.

_____
_____
_____

Manufacturer's guarantees of the proposed and specified items are:

☐ Same ☐ Different (explain on attachment)

The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.

For use by Project Representative:

☐ Accepted ☐ Accepted as Noted

☐ Not Accepted ☐ Received Too Late

_____
(Date)

_____
(Telephone)

_____
(Contractor's Signature)

_____
(Contractor's Firm)

_____
(Firms Address)

_____

Comments:

SECTION 01 29 01
PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes:

1. Administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

A. For lump sum contracts, furnish a statement allocating portions of the Contract Sum to various portions of the Work which will be used as the basis for reviewing Applications for Payment.

1. Submit preliminary Schedule of Values utilizing the template format and work breakdown provided as an attachment to this Section within 10 days after the effective date of the Agreement.
2. Before submittal of first progress payment, make corrections and adjustments as necessary to obtain an acceptable Schedule of Values and resubmit to the Engineer.
    a. No progress payment requests will be processed until the Schedule of Values is accepted by the Engineer.

B. Format and Content:

1. Use the form provided and supplement as necessary using the Project Manual table of contents as a guide to establish additional line items for the Schedule of Values. Provide at least one line item for each Specification Section.
2. Include the following project identification on the Schedule of Values:
    a. Project name, location, and Owner contract/project number.
    b. Name of Engineer.
    c. Engineer's project number.
    d. Contractor's name and address.
    e. Date of submittal.
3. Arrange the Schedule of Values for the lump sum Bid Item No. 1 (or, alternatively, the Bid Item No. fully executed) per Specification Section 00 80 00, with the following subdivisions, description of work and dollar values for each:
    a. Subcontractor work.
    b. Manufacturer or fabricator.
    c. Supplier.
    d. Contractor work.
4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
7. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense at Contractor's option.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as recommended by the Engineer and approved by Owner.

B. The date for each progress payment is on or about the first of each month. The period covered by each Application for Payment starts on the day following the end of the preceding period and ends 10 days before the date for each progress payment.

C. Requests for progress payments shall be submitted at least 10 days before the date established for each progress payment, but not more often than once a month. Use forms provided in Contract Documents for Applications for Payment.

D. Application Preparation Procedures:

1. When requested by the Contractor, the Engineer will determine the estimated quantities and classifications of Unit Price Work performed.
    a. Preliminary determinations will be reviewed with the Contractor before submitting Application for Payment.
    b. Contractor will complete the Application for Payment based on Engineer's decision on actual quantities and classifications.
    c. Engineer will submit copies of Application for Payment to Contractor for certification.
        1) Contractor shall submit signed Application for payment to Owner for approval within time frame agreed to at the Preconstruction Conference.
2. For a lump sum price contract, the Contractor shall prepare a preliminary determination for payment based on the approved Schedule of Values and review with Engineer before completing Application for Payment.
    a. Payment for lump sum bid items shall be in the amount of scheduled values of each of the aggregate components comprising the lump sum items multiplied by the respective percent completion estimate.
3. If payment is requested for materials and equipment not incorporated in the Work, then the following shall be submitted with the Application for Payment:
    a. Evidence that materials and equipment are suitably stored at the site or at another location agreed to in writing.
    b. A bill of sale, invoice, or other documentation warranting that the materials and equipment are free and clear of all liens.
    c. Evidence that the materials and equipment are covered by property insurance.
4. Complete every entry on form. Execute by a person authorized to sign legal documents on behalf of Contractor.

E. With each Application for Payment, submit the Following Documents:

1. Waivers of liens from subcontractors and suppliers for the construction period covered by the previous application.
    a. Submit partial waivers on each item for amount requested before deduction for retainage on each item.
    b. When an application shows completion for an item, submit final or full waivers.
    c. Owner reserves the right to designate which entities involved in the Work shall submit waivers.
    d. Submit final Application for Payment with or proceeded by final waivers from every entity involved with performance of the Work covered by the application.
    e. Submit waivers of lien on forms executed in a manner acceptable to Owner.
2. Project schedule updated in accordance with criteria contained in Section 01 11 20 - Job Conditions.

F. The following administrative actions and submittals shall precede or coincide with submittal of first Application for Payment:

1. List of subcontractors.
2. Schedule of Values.
3. Contractor's construction schedule.
4. Copies of applicable permits.
5. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

G. Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Consent of Surety to Final Payment.
5. Final lien waivers as evidence that claims have been settled.
6. Final liquidated damages settlement statement.
7. Requirements listed in Section 01 77 01 - Closeout Procedures.

1.4 MEASUREMENT AND PAYMENT

A. Lump Sum Bid Items General:

1. Measurement of lump sum bid items will be based on an estimated percent complete of the various components of the lump sum item established by the Contractor's Schedule of Values and approved by the Engineer. Contractor will make progress estimates on or about the first day of the month and submit to Engineer for review and approval.

B. Unit Price Items:

a. Measurement of unit price items will be based on field measurements within the project limits. See Measurement and Payment Section 01 22 00 for more information.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

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SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project meetings including, but not limited to, the following:

1. Preconstruction conference.
2. Progress meetings.
3. Preinstallation conferences.

1.2 PRECONSTRUCTION CONFERENCE

A. Engineer will schedule a preconstruction conference held at the Metro Park West Landfill within 10 days after the Contract Time start and before Work at the site is started.

B. Authorized representatives of the Owner, Engineer, the Contractor and its project manager and superintendent; major subcontractors; and other concerned parties shall attend the conference.

1. All participants at the conference shall be familiar with the Project and authorized to make binding decisions of matters relating to the Work.

C. The Engineer will record meeting notes and distribute notes to the Owner, Contractor, and other parties agreed upon by the Owner.

1.3 PROGRESS MEETINGS

A. Progress meetings at the Project site will be scheduled by the Engineer at regular intervals, currently anticipated to be biweekly.

B. In addition to representatives of the Owner, the Engineer and the Contractor, each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities prior to the next progress meeting shall be represented at these meetings. All participants at the conference shall be familiar with the Project and authorized to make binding decisions on matters relating to the Work.

C. Proposed meeting agenda may include:

1. Review progress since the last meeting.
2. Review the present and future needs of each entity present, including the following:
    a. Interface requirements.
    b. Time.
    c. Sequences.
    d. Status of submittals.
    e. Deliveries.
    f. Off-site fabrication problems.
    g. Access.
    h. Site utilization.
    i. Temporary facilities and services.
    j. Hours of work.
    k. Hazards and risks.
    l. Housekeeping.
    m. Quality and work standards.
    n. Change orders.
    o. Documentation of information for payment requests.

D. Updated project schedules, submitted in accordance with Section 01 29 01 – Payment Procedures, shall be provided by the Contractor at the meeting.

1. Reflect the current status (updated by the Contractor) as of the time of the meeting.
2. Subsequent to the meeting the schedule shall be updated to reflect issues addressed at Project Meetings.

E. Review Status of On-Site Record Documents.

F. The Engineer will record meeting notes and distribute notes to the Owner, Contractor, and other parties agreed upon by the Owner.

1.4 PRE-INSTALLATION CONFERENCES

A. Contractor shall schedule a pre-installation conference at the Project site at least 7 days before each construction activity that requires coordination with other construction. The schedule shall be coordinated with the Engineer and Owner.

B. The 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.

1. Advise the Engineer of scheduled meeting dates.
2. Engineer will record significant discussions, agreements and disagreements of each conference and the approved schedule and will distribute the record of the meeting to the Contractor, Owner and other parties agreed upon by the Owner.
3. Do not proceed with the installation of items not successfully concluded.
4. Initiate whatever actions are necessary to resolve impediments to performance of Work and reconvene the conference at the earliest feasible date.

PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

SECTION 01 31 26
ELECTRONIC COMMUNICATION PROTOCOLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Procedures with which Users will comply regarding transmission or exchange of Electronic Documents for the Project.

B. Related Requirements:

1. Refer to the General Conditions, as may be modified by the Supplementary Conditions, regarding transmitting Electronic Documents by Electronic Means.
2. In addition to the requirements of this Specifications Section, comply with the requirements for Electronic Documents in the following Specifications:
   a. Section 01 33 00 - Submittals.

1.2 DEFINITIONS

A. The following terms are defined for use in this Specifications Section and are indicated herein using initial capital letters. The terms have the associated meaning regardless of whether indicated in singular or plural.

1. Electronic Documents Protocol (abbreviated as “EDP”): Procedures and requirements set forth in this Specifications Section for the exchange of Electronic Documents by Electronic Means.
2. Project Website: An internet-based software platform, such as a website or other project management information system (PMIS) designated by Contract or mutual consent of Users as the means of exchanging Electronic Documents during the Project.
3. System Infrastructure: Hardware, operating system(s) software, internet access, e-mail service and software, security software, and large-file transfer functions.
4. Users: Owner, Contractor, Engineer, and others exchanging Electronic Documents on the Project in accordance with the EDP.

1.3 ADMINISTRATIVE REQUIREMENTS.

A. Coordination:

1. Contractor shall require all Subcontractors and Suppliers to comply with the EDP established in the Contract Documents.

1.4 GENERAL PROVISIONS OF ELECTRONIC DOCUMENT PROTOCOL

A. EDP – General:

1. To the fullest extent practical, Users agree to and will transmit and accept Electronic Documents transmitted by Electronic Means in accordance with the requirements of this Specifications Section. Use of the Electronic Documents and any information contained therein is subject to requirements of this Specifications Section and other provisions of the Contract Documents governing transmittal of Electronic Documents.
2. Content of Electronic Documents will be the responsibility of transmitting User.
3. Unless otherwise provided in: (1) the EDP, (2) elsewhere in the Contract Documents, or (3) or other agreement between two or more Users governing use of Electronic Documents, Electronic Documents exchanged in accordance with the Contract Documents may be used in the same manner as paper or other printed versions of the same documents exchanged using other than Electronic Means, subject to the same governing requirements, limitations, and restrictions set forth in the Contract Documents.

4. Except as otherwise explicitly indicated in the EDP, the terms of this EDP will be incorporated into any other agreement or subcontract between a party and a third party for a portion of the Work or Project-related services, where such third party is, either directly or indirectly, required to exchange Electronic Documents with Owner, Contractor, or Engineer. Nothing in this EDP modifies the requirements of the Contract Documents regarding communications between and among Owner, Contractor, and Engineer Subcontractors, Suppliers, consultants, and others for which each is responsible.
5. When transmitting Electronic Documents, transmitting User makes no representations regarding long-term compatibility, usability, or readability of the items resulting from the receiving User's use of software applications or System Infrastructure differing from those established in this EDP.
6. This EDP does not negate or mitigate any obligation: (1) in the Contract Documents to create, provide, or maintain an original paper record version of Drawings and Specifications, signed and sealed in accordance with Laws or Regulations; (2) to comply with Laws and Regulations governing signing and sealing of design documents or signing and electronic transmission of other documents; or (3) to comply with notice requirements of the General Conditions (as. May be modified by the Supplementary Conditions).
7. Modifications to EDP:
    a. When modifications to the EDP are necessary to address issues affecting System Infrastructure, Users shall cooperatively resolve the issues.
    b. If resolution within a reasonable time is not achieved, Owner is empowered to require reasonable and necessary changes to the EDP consistent with the original intent of the EDP.
    c. If such changes result in additional cost or delay to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in the Contract Price, Contract Times, or both in accordance with the Contract Documents.

B. System Infrastructure and Systems for Exchanging Electronic Document:

1. Each User will provide System Infrastructure (as defined in this EDP) at its own cost and sufficient for complying with EDP requirements. Except for minimum standards set forth in this EDP, it is the obligation of each User to determine, for itself, such User's own System Infrastructure.
    a. Maximum size of e-mail file attachment for under this EDP is 5 megabytes (MB). Attachments larger than the maximum size indicated in this paragraph may be exchanged using large-file transfer functions (such as file exchange websites or FTP sites mutually acceptable to the Users) or physical media such as USB flash drive/thumb drive or other physical media mutually acceptable to the Users.
    b. Each entity transmitting or receiving Electronic Documents has full responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, and otherwise enabling its System Infrastructure for use in accordance with this EDP.
    c. Each User will provide its own printing facilities and will be responsible for its own costs of printing Electronic Documents.
2. Each User is responsible for its own system operations, security, back-up, archiving, audits, and other technology and resources for operations of its System Infrastructure during the Project, including coordination with the User's individual(s) or subcontractor(s) responsible for managing its System Infrastructure and capable of addressing communications and other technology issues affecting exchange of Electronic Documents.

3. Security:
    a. Each User will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems to protect against threats including software viruses and other malicious software including worms, trojans, adware; data breaches; loss of confidentiality; and other threats in transmission to, or storage of, Electronic Documents from other Users, including transmission of Electronic Documents by physical media including flash drives/thumb drives, hard drives, compact discs (CD), digital video discs (DVD), and other portable devices, whether connected physically or wirelessly.
    b. To the extent that a User maintains and operates such security software and appropriate System Infrastructure, such User will not be liable to other Users participating in the Project for breach of system security.
4. Archiving and Electronic Document Backup:
    a. Each User is responsible for its own back-up and archive of Electronic Documents and data transmitted and received during the Project, unless this EDP establishes a Project Electronic Document archive, either as a mandatory Project Website or other communications protocol, upon which Users may rely for Electronic Document archiving for the duration of the Project Website or archiving system established in this EDP.
    b. Each User is solely responsible for its own post-Project back-up and archive of Electronic Documents after the Project is complete or after termination of the Project Website or other Project archive (as applicable), for the longer of: (1) required by the Contract Documents, (2) required by Laws and Regulations, and (3) as each User deems necessary for its purposes.
5. Receipt of Damaged, Incomplete, or Corrupt Electronic Documents: When a receiving User receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving User will advise the transmitting User of the incomplete transmission and transmitting User will retransmit the Electronic Document.
6. Completion of Transmittals: Users will bring non-conforming Electronic Documents into compliance with the EDP. Users will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the transfer of the Electronic Documents.
7. Principal means of exchanging Electronic Documents will be e-mail and files attached to e-mail, in accordance with the EDP.
8. Project Website:
    a. Owner will establish, operate, and maintain a Project Website (as defined in this EDP) for use of Owner, Engineer, Contractor, and other Users as appropriate during the Project, for exchanging and storing Project Electronic Documents.
    b. Unless otherwise provided in the Contract Documents, use of Project Website by Owner, Contractor, and Engineer is mandatory for exchanging Project documents as set forth in the EDP.
    c. Project Website Conditions and Standards:
        1) Software Platform: Microsoft SharePoint.
        2) Duration of Project Website Availability and Reliance by Users: The date final payment is due Contractor under the Contract.
        3) Services and Functions Available on Project Website: Large-file transfer, submittal transfer, Electronic Document archiving.
    d. Address of Project Website will be furnished to Contractor, and Project Website will be available to Contractor, within 10 days following the Effective Date of the Contract.

C. General Requirements and Limitations for Software for Electronic Document Exchange:
    1. Software and file formats for exchange of Electronic Documents shall be as indicated in Article 1.5 of this Specifications Section.

2. Software Versions:
    a. Each User will acquire the software and associated licenses necessary to create, transmit, receive, read, and us Electronic Documents for the Project, using the software and file formats indicate in Article 1.5 of this Specifications Section.
    b. Prior to using any updated version of the software required in the EDP for Electronic Document(s) transmitted to other User(s), the originating User will first notify and either (1) receive concurrence from receiving User(s) for use of the updated version, or (2) adjust its transmission to comply with the EDP.
3. Preservation of Intellectual Property and Confidentiality of Electronic Documents:
    a. Users agree to not intentionally edit, reverse-engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes Electronic Documents, and information and data contained therein, transmitted in a file format, including portable document format (PDF), intended by transmitting User to not be modified, unless the receiving User (1) obtains permission from owner of the Electronic Document and intellectual property contained therein, or (2) is expressly allowed by the EDP to edit or modify the Electronic Document.
    b. Where modifying, editing, decryption, or reverse-engineering is allowed by the EDP, such use is conferred only for the Project.
    c. The EDP does not transfer any ownership or rights of any sort regarding use outside of the Project of Electronic Documents.
    d. Users shall not cite or quote excerpts of Electronic Documents for purposes outside of the Project unless required to do so by Laws and Regulations.

D. Contractor's Requests for Electronic Documents in Other Formats:
1. Release of Electronic Documents in format(s) other than those indicated in in Article 1.5 of this Specifications Section and elsewhere in the Contract Documents will be at the discretion of Owner and subject to terms and conditions required by the owner of such files and documents, and the provisions indicated below.
2. To extent determined by Owner, in its sole discretion, to be appropriate, release of Electronic Documents in alternative format(s) requested by Contractor ("Request") are subject to provisions of Owner's response to the Request and to the following:
    a. Contractor's Request shall be in writing. Owner and others, as appropriate, will consider and respond to Request promptly, but neither Owner nor Engineer will be responsible for any time or cost impacts on Contractor associated with timing of the Request, or with Owner's decision associated therewith.
    b. When Engineer is the owner of the Electronic Documents requested by Contractor in native format, prior to Engineer transmitting such Electronic Documents to Contractor, Contractor shall sign and deliver to Engineer, without modifying or amending, Engineer's "Electronic Media Release" agreement.
    c. Content included in Electronic Documents created by Engineer and furnished in response to the Request was prepared by Engineer as an internal working document for Engineer's purposes solely and, when provided to Contractor, is on an "as-is" basis without warranties of any kind, including, but not limited to any implied warranties of fitness for purpose. Contractor acknowledges that content of Electronic Documents furnished in response to the Request may not be suitable for Contractor's purpose(s), or may require substantial modification and independent verification by Contractor. Content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other shown or indicated information that may affect subsequent use by Contractor or others for whom Contractor is responsible.

d. Electronic Documents containing text, graphics, metadata, or other types of data furnished by Engineer in response to the Request are only for Contractor's convenience and any and all conclusions or information obtained or derived from such Electronic Documents will be at Contractor's sole risk and expense. Contractor waives any and all claims against Engineer, Owner, or both arising from Contractor's use of Electronic Documents furnished in response to the Request.

e. Contractor shall indemnify and hold harmless Owner, Engineer, and their respective consultants and subconsultants from any and all claims, damages, losses, and expenses, including attorneys' fees and defense costs, fees and costs of engineers, architects, geologists, accountants, and other professionals, and any and all other costs, direct and indirect, resulting from Contractor's use, adaptation, or distribution of Electronic Document(s) furnished in response to the Request.

f. Contractor shall not sell, copy, transfer, forward, give away or otherwise distribute the Electronic Documents (in source format or modified file format) to any third party without direct written authorization of Engineer or other entity that owns the Electronic document(s), unless such distribution is specifically indicated in the Request and is limited to Subcontractors and Suppliers. Contractor warrants that subsequent use by Subcontractors and Suppliers complies with terms and conditions of the Contract Documents, Owner's response to the Request, and release agreement(s) (if any) by owner of the Electronic Documents (including Engineer, where applicable).

3. When the Request is for Electronic Documents in a format not other than that indicated in the Contract Documents, and Owner (and others, as applicable) decide to comply with the Request, and when the requested Electronic Documents are not easily available in the format(s) requested, Contractor shall reimburse Owner for costs incurred by Owner, either directly or indirectly, to furnish Electronic Documents in accordance with the Request at a price agreed upon between the Contractor and Owner to furnish the requested format(s). In compensation, Owner may retain such amount(s) as set-off(s) under the Contract Documents.

1.5 EXCHANGE OF ELECTRONIC DOCUMENTS

A. Comply with the Electronic Document formats, transmission methods, and permitted uses set forth in Table 01 31 26-A, Exchange of Electronic Documents, below, when transmitting or using Electronic Documents on the Project. Where a row in the table has no indicated means of transmitting Electronic Documents, use for such documents only paper copies transmitted to the receiving party via appropriate delivery method.

TABLE 01 31 26-A – EXCHANGE OF ELECTRONIC DOCUMENTS

Electronic Document Type	Format	Transmitting User	Transmission Method	Receiving User	Allowed Uses	Notes
1.5.A.1. Project communications						
General communications & correspondence	EM, PDF	O, E, C	EM, EMA	O, E, C	R	
Meeting notices and agendas	EM, PDF	E	EM, EMA	O, C	R	
Meeting minutes	PDF	E	EM, EMA	O, C	R	
1.5.A.2. Contractor's Submittals to Engineer						
Shop Drawings	PDF	C	EM, EMA	E	M (1)	(1)
Product data Submitals, delegated design Submittals, and other action Submittals (except Samples)	PDF	C	EM, EMA	E	M (1)	(1)
Informational and closeout Submittals:	PDF	C	EM, EMA	E	M (1)	(1) (6)

Electronic Document Type	Format	Transmitting User	Transmission Method	Receiving User	Allowed Uses	Notes
Documentation of delivery of maintenance materials Submittals	PDF	C	EM, EMA	E	M (1)	
1.5.A.3. Engineer's return of reviewed Submittals to Contractor						
Shop Drawings	PDF	E	EM, EMA	O., C	R	
Product data Submittals, delegated design Submittals, and other action Submittals	PDF	E	EM, EMA	O., C	R	
Informational and closeout submittals:	PDF	E	EM, EMA	O., C	R	(6)
Documentation of delivery of maintenance materials submittals	PDF	E	EM, EMA	O. C	R	
1.5.A.4. Contract Modifications Documents						
Requests for interpretation to Engineer	PDF	C., O	EM, EMA	E	M (1)	(1)
Engineer's interpretations (RFI responses)	PDF	E	EM, EMA	C, O	R	
Engineer's clarifications to Contractor	EM, PDF	E	EM, EMA	C, O	R	
Engineer's issuance of Field Orders	PDF	E	EM, EMA	C, O	R	
Proposal Requests	PDF	E, O	EM, EMA	C	R	
Change Proposals – submitted to Engineer	PDF	C	EM, EMA	O, E	S	
Change Proposals – Engineer's response	PDF	E	EM, EMA	C. O		
Work Change Directives (for Contractor signature)	PDF	E	EM, EMA	C	R	(2)
Change Orders (for Contractor signature)	PDF	E	EM, EMA	C	R	(2)
1.5.A.5. Applications for Payment						(3)
1.5.A.6. Claims and other notices						(4)
1.4.A.7. Closeout Documents						
Record drawings	DWG and PDF	C	EM, EMA	E, O	M (5)	(5)
Other record documents	PDF	C	EM, EMA	E. O	M (5)	(5)
Contract closeout documents						

1. Key to Table 01 31 26-A:
   a. Data Format:
      1) EM: .msg, .htm, .txt, .rtf, e-mail text.
      2) W: .docx, Microsoft Word 2013 or later.
      3) EX: .xlsx, Microsoft Excel 2013 or later.
      4) PDF: .pdf. portable document format.
      5) DWG: .dwg. Autodesk AutoCAD 2014 Drawing.

b. Transmitting User:
   1) O: Owner.
   2) C: Contractor.
   3) E: Engineer.
c. Transmission Method:
   1) EM: Via e-mail.
   2) EMA: Attachment to e-mail transmission.
   3) PORT: Delivered via portable media such as flash drive/thumb drive, CD, or DVD.
   4) PW: Posted to Project Website.
   5) FTP: FTP transfer to receiving FTP server.
d. Receiving User:
   1) O: Owner.
   2) C: Contractor.
   3) E: Engineer.
e. Permitted Uses:
   1) S: Store and view only.
   2) R: Reproduce and distribute.
   3) I: Integrate (incorporate additional electronic data without modifying data received).
   4) M: Modify as required to fulfill obligations for the Project.
f. Notes:
   1) Modifications by Engineer to Contractor's Submittals and requests for interpretations are limited to printing, marking-up, and adding comment sheets.
   2) May be distributed only to affected Subcontractors and Suppliers. Print, sign document, and return signed paper originals to Engineer.
   3) Submit printed Applications for Payment with original ("wet") signatures.
   4) Submit notices, including Claims, in accordance with the notice provisions of the General Conditions, as may be modified by the Supplementary Conditions.
   5) Submit Record Drawings in native CAD format indicated when Contractor has signed Engineer's standard agreement for release of electronic media. In addition, always submit Record Drawings as PDF files. Comply with Contract Documents requirements for Project Record Documents.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 33 00
SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mechanics and administration of the submittal process for:
    a. Shop Drawings.
    b. Samples.
    c. Miscellaneous submittals.
2. General content requirements for Shop Drawings.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
2. Division 01 - General Requirements.
3. Sections in Divisions 2 through 40, as applicable, identifying required submittals.

1.2 DEFINITIONS

A. Shop Drawings:

1. See General Conditions.
2. Product data and samples are Shop Drawing information.

B. Miscellaneous Submittals:

1. Submittals other than Shop Drawings.
2. Representative types of miscellaneous submittal items include but are not limited to:
    a. Construction schedule.
    b. Soil compaction test reports.
    c. Geosynthetic materials tests.
    d. Installed equipment and systems performance test reports.
    e. Manufacturer's installation certification letters.
    f. Warranties.
    g. Evidence of Health and Safety Plan implementation.
    h. Survey data.
    i. Cost breakdown (Schedule of Values).

3. For-Information-Only submittals upon which the Engineer is not expected to conduct review or take responsive action may be so identified in the Contract Documents.

1.3 SUBMITTAL SCHEDULE

A. Schedule of Shop Drawings:

1. Prepare a schedule identifying all submittals anticipated and the timeframe in which they will be submitted.
2. Submitted and approved within 10 days of receipt of Notice to Proceed.
3. Account for multiple transmittals under any Specification Section where partial submittals will be transmitted.

B. Shop Drawings:

1. Submittal and approval of all Shop Drawings shall be completed within 20 days of Notice to Proceed, unless the content prevents submittal within such a timeframe.

1.4 PREPARATION OF SUBMITTALS

A. General:

1. All submittals and all pages of all copies of a submittal shall be completely legible.
2. Submittals which, in the Engineer's sole opinion, are illegible will be returned without review.

B. Shop Drawings:

1. Scope of any submittal and letter of transmittal:
   a. Limited to one specification section.
   b. Do not submit under any Specification Section entitled (in part) "Basic Requirements" unless the product or material submitted is specified in a "Basic Requirements" Specification Section.
2. Numbering letter of transmittal:
   a. Include as prefix the specification section number followed by a series number ("-xx", beginning with "01") and increasing sequentially with each additional transmittal.
   b. If more than one submittal under any specification section, assign consecutive series numbers to subsequent transmittal letters.
3. Describing transmittal contents:
   a. Provide listing of each component or item in submittal capable of receiving an independent review action.
   b. Identify for each item:
      1) Manufacturer and Manufacturer's Drawing or data number.
      2) Contract Document tag number(s).
      3) Unique page numbers for each page of each separate item.

c. When submitting "or-equal" items that are not the products of named manufacturers, include the words "or-equal" in the item description.

4. Contractor certification of review and approval:

a. Contractor's review and approval stamp shall be applied either to the letter of transmittal or a separate sheet preceding each independent item in the submittal.

1) Stamp may be either a wet ink stamp or electronically embedded.

2) Clearly identify the person who reviewed the submittal and the date it was reviewed.

3) Shop Drawing submittal stamp shall read "(Contractor's Name) has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval as stipulated in the General Conditions."

4) Letters of transmittal may be stamped only when the scope of the submittal is one item.

b. Submittals containing multiple independent items shall be prepared with an index sheet for each item listing the discrete page numbers for each page of that item, which shall be stamped with the Contractor's review and approval stamp.

1) Individual pages or sheets of independent items shall be numbered in a manner that permits Contractor's review and approval stamp to be associated with the entire contents of a particular item.

5. Resubmittals:

a. Number with original root number and a suffix letter starting with "A" on a (new) duplicate transmittal form.

b. Do not increase the scope of any prior transmittal.

c. Provide cover letter indicating how each "B", "C", or "D" Action from previous submittal was addressed and where the correction is found in the resubmittal.

d. Account for all components of prior transmittal.

1) If items in prior transmittal received "A" or "B" Action code, list them and indicate "A" or "B" as appropriate.

a) Do not include submittal information for items listed with prior "A" or "B" Action in resubmittal.

2) Indicate "Outstanding-To Be Resubmitted at a Later Date" for any prior "C" or "D" Action item not included in resubmittal.

a) Obtain Engineer's approval to exclude items.

6. For 8-1/2 x 11 IN, 8-1/2 x 14 IN, and 11 x 17 IN size sheets, provide three (3) copies of each page for Engineer plus the number required by the Contractor.

a. The number of copies required by the Contractor will be defined at the Preconstruction Conference but shall not exceed 3.

b. All other size sheets:

1) Submit one (1) reproducible transparency or high resolution print and one (1) additional print of each drawing until approval is obtained.

2) Utilize mailing tube; do not fold.

3) The Engineer will mark and return the reproducible to the Contractor for his reproduction and distribution.

7. Provide clear space (3 IN SQ) for Engineer stamping of each component defined in PREPARATION OF SUBMITTALS – Contractor Stamping.

8. Contractor shall not use red color for marks on transmittals.

   a. Duplicate all marks on all copies transmitted, and ensure marks are photocopy reproducible.

   b. Engineer will use red marks or enclose Engineer's marks in a cloud.

9. Transmittal contents:

   a. Coordinate and identify Shop Drawing contents so that all items can be easily verified by the Engineer.

   b. Provide submittal information or marks defining specific equipment or materials utilized on the Project.

      1) Generalized product information, not clearly defining specific equipment or materials to be provided, will be rejected.

   c. Identify equipment or material use, tag number, Drawing detail reference, weight, and other project specific information.

   d. Provide sufficient information together with technical cuts and technical data to allow an evaluation to be made to determine that the item submitted is in compliance with the Contract Documents.

   e. Do not modify the manufacturer's documentation or data except as specified herein.

   f. Submit items such as equipment brochures, cuts of fixtures, product data sheets or catalog sheets on 8-1/2 x 11 IN pages.

      1) Indicate exact item or model and all options proposed.

   g. When a Shop Drawing submittal is called for in any specification section, include as appropriate, scaled details, sizes, dimensions, performance characteristics, capacities, test data, anchoring details, installation instructions, storage and handling instructions, color charts, layout drawings, rough-in diagrams, wiring diagrams, controls, weights and other pertinent data in addition to information specifically stipulated in the specification section.

      1) Arrange data and performance information in format similar to that provided in Contract Documents.

      2) Provide, at minimum, the detail specified in the Contract Documents.

   h. If proposed equipment or materials deviate from the Contract Drawings or Specifications in any way, clearly note the deviation and justify the said deviation in detail in a separate letter immediately following transmittal sheet. Any deviation from Plans or Specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

10. Samples:
    a. Identification:
        1) Identify sample as to transmittal number, manufacturer, item, use, type, project designation, tag number, standard specification section or drawing detail reference, color, range, texture, finish and other pertinent data.
        2) If identifying information cannot be marked directly on sample without defacing or adversely altering samples, provide a durable tag with identifying information securely attached to the sample.
    b. Include application specific brochures, and installation instructions.
    c. Provide Contractor's review and approval certification stamp or Contractor's Submittal Certification form as indication of Contractor's checking and verification of dimensions and coordination with interrelated work.
    d. Resubmit samples of rejected items.

C. Miscellaneous Submittals:

1. Prepare in the format and detail specified in specification requiring the miscellaneous submittal.

1.5 TRANSMITTAL OF SUBMITTALS

A. Shop Drawings, Samples:

1. Transmit all submittals to:
    a. As Designated at Pre-Construction Conference.
2. Utilize two (2) copies of attached Exhibit "A" to transmit all Shop Drawings and samples.
3. All submittals must be from Contractor.
    a. Submittals will not be received from or returned to subcontractors.

B. Miscellaneous Submittals:

1. Transmit under Contractor's standard letter of transmittal or letterhead.
2. Submit in triplicate or as specified in individual specification section.
3. Transmit to:
    a. As Designated at Pre-Construction Conference.
4. Provide copy of letter of transmittal to Owner's and Engineer's Representative.
    a. Exception for concrete, soils compaction and pressure test reports.
        1) Transmit one copy to Owner and Engineer’s Representative.
        2) Transmit one copy to location and individual indicated above for other miscellaneous submittals.

C. Electronic Transmission of Submittals:

1. Transmittals may be made electronically.

a. Use Owner's project-specific cloud-based server system (i.e., Dropbox or similar) and an email to the Engineer containing links to each unique submittal to formally time and date stamp each submittal.

b. Protocols and processes will be determined at the Pre-Construction Conference.

2. Scan all transmittals into Adobe Acrobat Portable Document Format (PDF), latest version, with printing enabled.

a. Do not password protect or lock the PDF document.

b. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.

3. Required signatures may be applied prior to scanning for transmittal.

1.6 ENGINEER'S REVIEW ACTION

A. Shop Drawings and Samples:

1. Items within transmittals will be reviewed for overall design intent and will receive one of the following actions:

a. A - FURNISH AS SUBMITTED.

b. B - FURNISH AS NOTED (BY ENGINEER).

c. C - REVISE AND RESUBMIT.

d. D - REJECTED.

e. E - ENGINEER'S REVIEW NOT REQUIRED.

2. Submittals received will be initially reviewed to ascertain inclusion of Contractor's approval stamp.

a. Submittals not stamped by the Contractor or stamped with a stamp containing language other than that specified herein will not be reviewed for technical content and will be returned rejected.

3. In relying on the representation on the Contractor's review and approval stamp, Owner and Engineer reserve the right to review and process poorly organized and poorly described submittals as follows:

a. Submittals transmitted with a description identifying a single item and found to contain multiple independent items:

1) Review and approval will be limited to the single item described on the transmittal letter.

2) Other items identified in the submittal will:

a) Not be logged as received by the Engineer.

b) Be removed from the submittal package and returned without review and comment to the Contractor for coordination, description and stamping.

c) Be submitted by the Contractor as a new series number, not as a re-submittal number.

b. Engineer, at Engineer's discretion, may revise the transmittal letter item list and descriptions, and conduct review.

1) Unless Contractor notifies Engineer in writing that the Engineer's revision of the transmittal letter item list and descriptions was in error, Contractor's review and approval stamp will be deemed to have applied to the entire contents of the submittal package.

4. Submittals returned with Action "A" or "B" are considered ready for fabrication and installation.

   a. If for any reason a submittal that has an "A" or "B" Action is resubmitted, it must be accompanied by a letter defining the changes that have been made and the reason for the resubmittal.

   b. Destroy or conspicuously mark "SUPERSEDED" all documents having previously received "A" or "B" Action that are superseded by a resubmittal.

5. Submittals with Action "A" or "B" combined with Action "C" (Revise and Resubmit) or "D" (Rejected) will be individually analyzed giving consideration as follows:

   a. The portion of the submittal given "C" or "D" will not be distributed (unless previously agreed to otherwise at the Preconstruction Conference).

      1) One copy or the one transparency of the "C" or "D" Drawings will be marked up and returned to the Contractor.

         a) Correct and resubmit items so marked.

   b. Items marked "A" or "B" will be fully distributed.

   c. If a portion of the items or system proposed are acceptable, however, the major part of the individual drawings or documents are incomplete or require revision, the entire submittal may be given "C" or "D" Action.

      1) This is at the sole discretion of the Engineer.

      2) In this case, some Drawings may contain relatively few or no comments or the statement, "Resubmit to maintain a complete package."

      3) Distribution to the Owner and field will not be made (unless previously agreed to otherwise).

6. Failure to include any specific information specified under the submittal paragraphs of the Specifications will result in the submittal being returned to the Contractor with "C" or "D" Action.

7. Calculations required in individual Specification Sections will be received for information purposes only, as evidence calculations have been stamped by the professional as defined in the specifications and for limited purpose of checking conformance with given performance and design criteria.

   a. The Engineer is not responsible for checking the accuracy of the calculations and the calculations will be returned stamped "E. Engineer's Review Not Required" to acknowledge receipt.

8. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than two submittals.

   a. Engineer will record Engineer's time for reviewing a third or 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, with said costs being deducted from the lump sum amount shown in the Contractor's Bid.

9. Transmittals of submittals which the Engineer considers as "Not Required" submittal information, which is supplemental to but not essential to prior submitted information, or items of information in a transmittal which have been reviewed and received "A" or "B" Action in a prior submittal, will be returned with Action "E. Engineer's Review Not Required."

10. Samples may be retained for comparison purposes.

    a. Remove samples when directed. Include in bid all costs of furnishing and removing samples.

11. Approved samples submitted or constructed, constitute criteria for judging completed work.

    a. Finished work or items not equal to samples will be rejected.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

END OF SECTION

1

EXHIBIT A

Shop Drawing Transmittal No. _____-_____

(Spec Section) (Series)

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address: 300 East Locust, Suite 210 Des Moines, IA 50309	HDR No.: Spec Section: Drawing/Detail No.:	
Attn:	Attn:	1st. Sub	ReSub.
Date Transmitted:	Previous Transmittal Date:		

Item No.	No. Copies	Description	Manufacturer	Mfr/Vendor Dwg or Data No.	Action Taken*

Remarks:

* The Action designated above is in accordance with the following legend:

A - Furnish as Submitted

B - Furnish as Noted

C - Revise and Submit
1. Not enough information for review.
2. No reproducibles submitted.
3. Copies illegible.
4. Not enough copies submitted.
5. Wrong sequence number.
6. Wrong resubmittal number.
7. Wrong spec. section.
8. Wrong form used.
9. See comments.

D - Rejected

E - Engineer's review not required
1. Submittal not required.
2. Supplemental Information. Submittal retained for informational purposes only.
3. Information reviewed and approved on prior submittal.
4. See comments.
5. Delegated Design - Submittal received as requested by the Contract Documents. The Engineer did not review the engineering or technical content of the submittal.

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. Any deviation from plans or specifications not depicted in the submittal or included but not clearly noted by the Contractor may not have been reviewed. Review by the Engineer shall not serve to relieve the Contractor of the contractual responsibility for any error or deviation from contract requirements.

Comments:

By Date

1

EXHIBIT AA

Contractor's Submittal Certification

Shop Drawing Transmittal No.: _____

Contract/Project Name: _____

_____

Company Name: _____

has

1. reviewed and coordinated this Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

2. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

3. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

4. 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.

☐ This Submittal **does not** contain any variations from the requirements of the Contract Documents.

☐ This Submittal **does** contain variations from the requirements of the Contract Documents. A separate description of said variations and a justification for them is provided in an attachment hereto identified as:

"Shop Drawing Transmittal No. _____Variation and Justification Documentation"

Insert picture file or electronic signature of Authorized Representative

_____ _____

Authorized Representative Date

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SECTION 01 33 04
OPERATION AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Administration of the submittal process for Operation and Maintenance Manuals.
2. Content requirements for Operation and Maintenance Manuals.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. General submittal requirements are specified in Specification Section 01 33 00 - Submittals.
4. Technical Specification Sections identifying required Operation and Maintenance Manual submittals.

1.2 DEFINITIONS

A. Equipment Operation and Maintenance Manuals:

1. Contain the technical information required for proper installation, operation and maintenance of process, electrical and mechanical equipment and systems.

B. Building Materials and Finishes Operation and Maintenance Manuals:

1. Contain the information required for proper installation and maintenance of building materials and finishes.

1.3 SUBMITTALS

A. List of all the Operation and Maintenance Manuals required by the Contract as identified in the Technical Specification Sections. These may be referred to as "Operation and Maintenance Data" submittals.

B. Operation and Maintenance Manuals:

1. Draft and final electronic copies.
2. Final paper copies: One.

1.4 SUBMITTAL SCHEDULE

A. List of Required Operation and Maintenance Manuals:

1. Submit list with Specification Section number and title within 90 days after Notice to Proceed.

B. Draft Operation and Maintenance Manuals:

1. Submit approvable draft manuals in electronic format (PDF) within 30 days following approval of the respective Shop Drawing.
   a. Include placeholders or fly sheet pages where information is not final or is missing from the draft manual.
2. All Draft Operation and Maintenance Manuals shall be received by no later than 50 PCT project completion.

C. Final Operation and Maintenance Manuals:

1. Final approval of Operation and Maintenance Manuals in electronic format (PDF) must be obtained 45 days prior to equipment start-up.
2. Provide paper copies and Electronic Documents (in portable document format, PDF files) by Electronic Means in accordance with Section 01 31 26 – Electronic Communication Protocols of approved final Operation and Maintenance Manuals in electronic format (PDF), a minimum of 30 days prior to equipment start-up.
3. Issue addenda to Final Approved Operation and Maintenance Manual to include:
    a. Equipment data that requires collection after start-up, for example but not limited to HVAC balancing reports, electrical switchgear, automatic transfer switch and circuit breaker settings.
    b. Equipment field testing data.
    c. Equipment start-up reports.

1.5 PREPARATION OF SUBMITTALS

A. General:

1. All pages of the Operation and Maintenance Manual submittal shall be legible.
    a. Submittals which, in the Engineer's sole opinion, are illegible will be rejected without review.
2. Identify each equipment item in a manner consistent with names and identification numbers used in the Contract Documents, not the manufacturer's catalog numbers.
3. Neatly type any data not furnished in printed form.
4. Operation and Maintenance Manuals are provided for Owner's use, to be reproduced and distributed as training and reference materials within Owner's organization.
    a. This requirement is:
        1) Applicable to both paper copy and electronic files.
        2) Applicable to materials containing copyright notice as well as those with no copyright notice.
5. Notify supplier and/or manufacturer of the intended use of Operations and Maintenance Manuals provided under the Contract.

B. Operation and Maintenance Manual Format and Delivery:

1. Draft electronic submittals:
    a. Provide manual in Adobe Acrobat Portable Document Format (PDF), latest version.
    b. Create one (1) PDF file for each equipment Operation and Maintenance Manual.
    c. Do not password protect or lock the PDF document.
    d. Scanned images of paper documents are not acceptable. Create the Operation and Maintenance Manual PDF file from the original source document.
    e. Drawings or other graphics must be converted to PDF file format from the original drawing file format and made part of the PDF document.
    f. Scanning of drawings is to be used only where actual file conversion is not possible and drawings must be scanned at a resolution of 300 DPI or greater.
    g. Rotate sheets that are normally viewed in landscape mode so that when the PDF file is opened the sheet is in the appropriate position for viewing.

h. Create bookmarks in the bookmarks panel for the Operation and Maintenance Manual cover, the Table of Contents and each major section of the Table of Contents.

i. Using Adobe Acrobat Standard or Adobe Acrobat Professional, set the PDF document properties, initial view as follows:
   1) Select File →Properties→Initial View.
   2) Select the Navigation tab: Bookmarks Panel and Page.
   3) Select the Page layout: Single Page Continuous.
   4) Select the Magnification: Fit Page.
   5) Select Open to page: 1.
   6) Set the file to open to the cover page of the manual with bookmarks to the left, and the first bookmark linked to the cover page.
   7) Window Options: Check the "Resize window to initial page" box.

j. Set the PDF file "Fast Web View" option to open the first several pages of the document while the rest of the document continues to load.
   1) To do this:
      a) Select Edit→Preferences→ Documents→Save Settings.
      b) Check the "Save As optimizes for Fast Web View" box.

k. PDF file naming convention:
   1) Use the Specification Section number, the manufacturer's name and the equipment description, separated by underscores.
   2) Example: 46 51 21_Sanitaire_Coarse_Bubble_Diffusers.pdf.
   3) Do not put spaces in the file name.

2. Final electronic submittals:
   a. Submit two copies as Electronic Documents (in portable document format, PDF files) by Electronic Means in accordance with Section 01 31 26 – Electronic Communication Protocols (one copy per electronic media), each secured in a protective case.
   b. Labeling:
      1) Provide the following printed labeling on all electronic media:
         a) Project name.
         b) Specification Section.
         c) Equipment names and summary of tag(s) covered.
         d) Manufacturer name.
         e) Date (month, year).
   c. Binding:
      1) Include labeled electronic media in a protective case.
         a) Bind protective case in three-ring binder, inserted at the front of the Final paper copy submittal.
         b) Protective case(s) to have means for securing electronic media to prevent loss (e.g., zip case, flap and strap, or equivalent).

3. Final paper copy submittals:
   a. Quantity: Provide two copies.
   b. Paper: 8.5 x 11 IN or 11 x 17 IN bright white, 20 LB paper with standard three-hole punching.

c. 3-Ring Binder:
    1) Provide D-ring binder with clear vinyl sleeves (i.e. view binder) on front and spine.
    2) Insert binder title sheet with the following information under the front and spine sleeves:
        a) Project name.
        b) Specification Section.
        c) Equipment names and summary of tag(s) covered.
        d) Manufacturer name.
        e) Date (month, year).
    3) Provide plastic sheet lifters prior to first page and following last page.
d. Drawings:
    1) Provide all drawings at 11 x 17 IN size, triple folded and three-hole punched for insertion into manual.
    2) Where reduction is not practical to ensure readability, fold larger drawings separately and place in three-hole punched vinyl envelopes inserted into the binder.
    3) Identify vinyl envelopes with drawing numbers.
e. Use plastic coated dividers to tab each section of each manual in accordance with the Table of Contents.

C. Equipment Operation and Maintenance Manual Content:
1. Provide a cover page as the first page of each manual with the following information:
    a. Manufacturer(s) Name and Contact Information.
    b. Vendor's Name and Contact Information.
    c. Date (month, year).
    d. Project Owner and Project Name.
    e. Specification Section.
    f. Project Equipment Tag Numbers.
    g. Model Numbers.
    h. Engineer's Name.
    i. Contractor's Name.
2. Provide a Table of Contents for each manual.
3. Provide Equipment Record sheets as follows:
    a. Printed copies of the Equipment Record (Exhibits B1, B2 and B3), as the first tab following the Table of Contents.
        1) For Instrumentation and Control equipment, International Society of Automation (ISA) Data Sheets will be acceptable in lieu of the Equipment Record sheets.
    b. Exhibits B1-B3 are available as Fillable PDF Form documents from the Engineer.
    c. Each section of the Equipment Record must be completed in detail; simply referencing the related equipment Operation and Maintenance Manual sections for nameplate, maintenance, spare parts or lubricant information is not acceptable.

d. For equipment involving separate components (for example, a motor and gearbox), a fully completed Equipment Record is required for each component.
e. Submittals that do not include the Equipment Record(s) will be rejected without further content review.

4. Provide a printed copy of the Manufacturer's Field Services report following the Equipment Record sheets.
5. Provide the following detailed information, as applicable:
   a. Use equipment tag numbers from the Contract Documents to identify equipment and system components.
   b. Equipment function, normal and limiting operating characteristics.
   c. Instructions for assembly, disassembly, installation, alignment, adjustment, and inspection.
   d. Operating instructions for start-up, normal operation, control, shutdown, and emergency conditions.
   e. Maintenance instructions, including lubrication instructions if applicable
   f. Troubleshooting guide.
   g. Mark each sheet to clearly identify specific products and component parts and data applicable to the installation for the Project; delete or cross out information that does not specifically apply to the Project.
   h. Parts lists:
      1) A parts list and identification number of each component part of the equipment.
      2) Exploded view or plan and section views of the equipment with a detailed parts callout matching the parts list.
      3) A list of recommended spare parts.
      4) List of spare parts provided as specified in the associated Specification Section.
      5) A list of any special storage precautions which may be required for all spare parts.
   i. General arrangement, cross-section, and assembly drawings.
   j. Electrical diagrams, including elementary diagrams, wiring diagrams, connection diagrams, and interconnection diagrams.
   k. Factory and field test data and performance curves (if applicable).
   l. As-constructed fabrication or layout drawings and wiring diagrams.
   m. Copy of the equipment manufacturer's warranty meeting the requirements of the Contract.
   n. Copy of any service contracts provided for the specific piece of equipment as part of the Contract.
6. Additional information as required in the associated equipment or system Specification Section.
7. Include in Submittal the final, configured control setpoints and similar configurable parameters provided in the equipment.

D. Building Materials and Finishes Operation and Maintenance Manual Content:

1. Provide a cover page as the first page of each manual with the following information:
   a. Manufacturer(s) Name and Contact Information.

b. Vendor’s Name and Contact Information.
c. Date (month, year).
d. Project Owner and Project Name.
e. Specification Section.
f. Model Numbers.
g. Engineer’s Name.
h. Contractor’s Name.

2. Provide a Table of Contents for each manual.
3. Building products, applied materials and finishes:
   a. Include product data, with catalog number, size, composition and color and texture designations.
   b. Provide information for ordering custom manufactured products.
4. Necessary precautions:
   a. Include product MSDS for each approved product.
   b. Include any precautionary application and storage guidelines.
5. Instructions for care and maintenance:
   a. Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods and recommended schedule for cleaning and maintenance.
6. Moisture protection and weather exposed products:
   a. Include product data listing, applicable reference standards, chemical composition, and details of installation.
   b. Provide recommendations for inspections, maintenance and repair.
7. Additional requirements as specified in individual product specifications.

E. National Fire Protection Association 70 (National Electrical Code) Documentation:

1. Assemble documented calculations of Arc-Fault Current, Equipment Available Fault Current and Short Circuit Current Rating (SCCR) provided as part of equipment submittals into one O&M manual volume.

1.6 TRANSMITTAL OF SUBMITTALS

A. Operation and Maintenance Manuals.

1. Transmit all submittals to:
   a. The address specified in Specification Section 01 33 00 - SUBMITTALS.
2. Transmittal form: Use Operation and Maintenance Manual Transmittal, Exhibit A.
3. Transmittal numbering:
   a. Number each submittal with the Specification Section number followed by a series number beginning with "-01" and increasing sequentially with each additional transmittal, followed by "-OM" (for example: 43 23 14-01-OM).
4. Submit draft and final Operation and Maintenance Manual in electronic format (PDF) to Engineer, until manual is approved.

1.7 ENGINEER'S REVIEW ACTION

A. Draft Electronic (PDF) Submittals:

1. Engineer will review and indicate one of the following review actions:
   a. A - ACCEPTABLE

b. B - FURNISH AS NOTED
c. C - REVISE AND RESUBMIT
d. D - REJECTED

2. Submittals marked as Acceptable or Furnish As Noted will be retained; however, the transmittal form will be returned with a request for the final paper and electronic documents to be submitted.
3. Copies of submittals marked as Revise and Resubmit or Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

B. Final Paper Copy Submittals:

1. Engineer will review and indicate one of the following review actions:
   a. A - ACCEPTABLE
   b. D - REJECTED
2. Submittals marked as Acceptable will be retained with the transmittal form returned as noted.
3. Submittals marked as Rejected will be returned with the transmittal form marked to indicate deficient areas.
4. Resubmit until approved.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

EXHIBIT A

Operation and Maintenance Manual Transmittal _____-_____ - OM

(Spec Section) (Series)

Project Name: | Date Received:

Project Owner: | Checked By:

Contractor: | Owner: | Log Page:

Address: | Address: | HDR No.:

Attn: | Attn: | 1st. Sub. ReSub.

Date Transmitted: | Previous Transmittal Date:

No. Copies	Description of Item	Manufacturer	Dwg. or Data No.	Action Taken*

Remarks:

To: | From: *HDR Engineering, Inc.*

Date:

* The Action designated above is in accordance with the following legend:

A - Acceptable, provide one (1) additional paper copy and two (2) Electronic Documents (in portable document format, PDF files) by Electronic Means in accordance with Section 01 31 26 – Electronic Communication Protocols for final review.

B - Furnish as Noted

C - Revise and Resubmit
This Operation and Maintenance Manual Submittal is deficient in the following area:

1. Equipment Records.
2. Functional description.
3. Assembly, disassembly, installation, alignment, adjustment & checkout instructions.
4. Operating instructions.
5. Lubrication & maintenance instructions.
6. Troubleshooting guide.
7. Parts list and ordering instructions.
8. Organization (binder, binder titles, index & tabbing).
9. Wiring diagrams & schematics specific to installation.
10. Outline, cross section & assembly diagrams.
11. Test data & performance curves.
12. Tag or equipment identification numbers.
13. Inclusion of all components & subcomponents.
14. Other - see comments.

D - Rejected

Comments:

By | Date

Distribution: Contractor | File | Field | Owner | Other

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EXHIBIT B1

Equipment Record

Equipment Data and Spare Parts Summary

Project Name				Specification Section:
Equipment Name				Year Installed:
Project Equipment Tag No(s).				
Equipment Manufacturer				Project/ Order No.
Address				Phone
Fax	Web Site		E-mail	
Local Vendor/Service Center				
Address				Phone
Fax	Web Site		E-mail	

MECHANICAL NAMEPLATE DATA

Equip.			Serial No.	
Make			Model No.	
ID No.	Frame No.	HP	RPM	Cap.
Size	TDH	Imp. Sz.	CFM	PSI
Other:				

ELECTRICAL NAMEPLATE DATA

Equip.				Serial No.				
Make				Model No.				
ID No.	Frame No.	HP	V.	Amp.	HZ	PH	RPM	SF
Duty	Code	Ins. Cl.	Type	NEMA	C Amb.	Temp. Rise	Rating	
Other:								

SPARE PARTS PROVIDED PER CONTRACT

Part No.	Part Name	Quantity

RECOMMENDED SPARE PARTS

Part No.	Part Name	Quantity

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EXHIBIT B2

Equipment Record

Recommended Maintenance Summary

Equipment Description	Project Equip. Tag No(s).	

RECOMMENDED BREAK-IN MAINTENANCE (FIRST OIL CHANGES, ETC.)	INITIAL COMPLETION * FOLLOWING START-UP							
	D	W	M	Q	S	A	RT	Hours

RECOMMENDED PREVENTIVE MAINTENANCE	PM TASK INTERVAL *							
	D	W	M	Q	S	A	RT	Hours

***** **D = Daily** **W = Weekly** **M = Monthly** **Q = Quarterly** **S = Semiannual** **A = Annual** **Hours = Run Time Interval**

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EXHIBIT B3

Equipment Record

Lubrication Summary

Equipment Description	Project Equip. Tag No(s).

Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					
Lubricant Point						
Lubricant Type		Manufacturer	Product	AGMA #	SAE #	ISO
	1					
	2					
	3					
	4					
	5					

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SECTION 01 35 05

ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archeological interest.
2. Sequencing site controls using a work schedule that balances the timing of land disturbance activities and the installation of measures to control erosion and sedimentation in order to reduce on-site erosion, off-site sedimentation and maintain water quality in a receiving stream.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. SUDAS Division 1.

1.2 SUBMITTALS

A. Contractor shall prepare all required compliance plans necessary for alternate management strategies. Such plans include those listed as Shop Drawings below.

B. Shop Drawings:

1. See Section 01 33 00.
2. Prior to the start of any construction activities submit:
   a. A detailed plan of all methods of control and preventive measures to be utilized for environmental protection.
   b. A drawing of the work area showing haul routes, storage areas, access routes and current land conditions including trees and vegetation stockpile areas, areas of planned disturbance beyond those designated, and any soil erosion and sediment control features (silt fence, or other best management practices) that will be disturbed and/or relocated.
   c. Modifications required by the construction activities to the Owner's approved storm water pollution prevention plan including the following provisions, if required.
3. Contractor is required to develop a project specific plan identifying spill prevention, containment and countermeasures addressing fuel storage and re-fueling operations and other chemical handling activities, if any.
   a. If the Contractor does not comply with the Owner's Stormwater Pollution Prevention Plan (SWPPP), the Contractor shall prepare and submit for Owner's approval a Project-specific SWPPP. Such a Project-specific SWPPP shall include the following:
      1) Erosion Protection:
         a) Code of Federal Regulations, 40 CFR 122.26, and the Iowa Administrative Code, 567-60: The Contractor shall comply with soil erosion control requirements of the Iowa Code, the Iowa Department of Natural Resources (IDNR) NPDES Permit and local ordinances. The Contractor shall take all necessary measurements to protect against erosion and dust pollution on this site.

b) Damage Claims: The Contractor will hold the Owner harmless from any and all claims of any type whatsoever resulting from damages to adjoining public or private property, including reasonable attorney's fees incurred to Owner. Further, if the Contractor fails to take necessary steps to promptly remove earth sedimentation or debris which comes onto adjoining public or private property, the Owner may, but need not, remove such items and deduct the cost thereof from amounts due the Contractor.

2) Stormwater Discharge Permit:
   a) The Owner has obtained a NPDES General Permit No. 1 for stormwater discharge associated with industrial activity from the IDNR. The Contractor and all subcontractors shall be responsible for compliance and fulfilling all requirements of the NPDES General Permit No. 1, including the Stormwater Pollution Prevention Plan/Erosion Control Plan.
   b) All documents related to the stormwater discharge permit shall be kept on site at all times and must be presented to the IDNR upon request. The on-site documents will include the Notice of Intent, Proof of Publication, Pollution Prevention Plan, Project Inspection Records and other items.
3) Pollution Prevention Plan:
   a) Site Description: Excavation and filling, trenching, grading, and drainage activities in this project will be required to drain to the existing sediment ponds.
   b) Potential sources of pollution as a result of this project relate to silts, clays, and sediment and other materials which may be transported as a result of a storm event from the construction site.
   c) Responsibility: The Pollution Prevention Plan illustrates general measures to be taken for compliance with the permit. All mitigation measures required as a result of activities are the responsibility of the Contractor. The Contractor shall take all actions necessary for installation of control measures for compliance with permit and SWPPP requirements.
   d) Controls: The Contractor shall be responsible for compliance and fulfilling all the requirements of the general permit, including, but not limited to, the following:
      (1) The Contractor shall protect adjoining property, including public utilities, sanitary and storm drainage systems and streets from any damage resulting from movement of earth or other debris from project site. Repair any damage immediately at no additional cost.
      (2) The Contractor shall prevent accumulation of earth, siltation or debris on adjoining public or private property from project site. Remove any accumulation of earth or debris immediately and take remedial actions for prevention.
      (3) Prior to site clearing and grading operations, Contractor shall install silt fence and sediment controls downstream of disturbing activities as required and as shown on the Drawings. Contractor will then proceed with project.
      (4) The Contractor shall route existing storm water flows away from construction area without disruption of existing flow paths in areas surrounding the Limits of Construction.
      (5) The Contractor shall preserve existing vegetation in areas not needed for construction.
      (6) Erosion control methods to be used on this project are shown on the Erosion Control Plan.

(7) As areas reach their final grade and upon the completion of the storm drainage system, provide additional siltation fence, temporary silt basins and earth dikes, silt fence ditch checks and silt fence enclosures around all storm inlets. The Contractor shall provide additional siltation fence and earth dikes as may be required on all embankments, earth stockpiles and other areas to provide control.

(8) The Contractor shall provide temporary and/or permanent seeding of areas as soon as practical upon completion of grading.

(9) If construction activity is not planned to occur in a disturbed area for at least twenty-one days, the area shall be stabilized by temporary erosion controls within fourteen days of ceasing construction activities. The Contractor is required to maintain all temporary and permanent erosion control measures in working order, including cleaning, repairing, replacement and sediment removal throughout the permit period. Cleaning of sediment control devices shall begin before the features have lost 50% of their capacity.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 INSTALLATION

A. The project area and control devices will be inspected by the Owner. The findings and actions taken of this inspection will be provided to the Contractor during the project. This plan may be revised based upon findings of the inspection. The Contractor shall implement all revisions.

B. Direct all storm water to the existing storm water sedimentation basins where possible.

C. Contractor shall develop localized storm water controls to comply with requirements of approved SWPPP.

D. Employ and utilize environmental protection methods, obtain all necessary permits, and fully observe all local, state, and federal regulations.

E. Land Protection:

1. Except for any work or storage area and access routes specifically assigned for the use of the Contractor, the land areas outside the limits of construction shall be preserved in their present condition. Contractor shall confine construction activities to areas defined for work within the Contract Documents. Alternate access routes which will result in land disturbance shall be submitted for approval as part of the work plan.
2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.
3. Unless earthwork is immediately covered, protect all side slopes and backslopes immediately upon completion of final grading.
4. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.
5. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut or disturb them without approval of the Engineer. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.
6. Grade all borrow areas to drain and prevent on-site ponding of water.

F. Solid Waste Disposal:

1. Contractor shall maintain the working area in a reasonably clear and orderly condition and collect solid waste on a daily basis or as directed by Engineer. Contractor is responsible for maintaining a refuse bin and/or receptacle at field office.

2. Contractor is responsible for proper disposal of all solid waste generated.
3. Degradable, non-hazardous solid waste generated on-site is approved for disposal at the active face of the landfill on site, at no cost to Contractor.
4. Solid waste generated off-site will not be brought onto or accepted at the site without payment of appropriate fees.
5. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in an alternate manner approved by Engineer and regulatory agencies.
6. Geosynthetic and pipe scraps may be disposed of at the landfill at no cost to the Contractor if delivered directly to the active face of the landfill daily by the Contractor.

G. Control of Concrete Waste:

1. Concrete slurry waste shall not be allowed to enter storm drains or watercourses and shall be collected and disposed of or placed in a temporary concrete washout facility.
2. A sign shall be installed adjacent to each temporary concrete washout facility to inform concrete equipment operators to utilize the proper facilities.
3. Temporary concrete washout facilities shall be located a minimum of 50 FT from storm drain inlets, open drainage facilities, protected vegetation, and water courses. Each facility shall be located away from construction traffic or access areas to prevent disturbance or tracking.
4. Temporary concrete washout facilities shall be constructed above grade or below grade at the option of the Contractor. Temporary concrete washout facilities shall be constructed and maintained in sufficient quantity and size to contain all liquid and concrete waste generated by washout operations.
    a. Above grade temporary concrete washout facility: Straw bales or sandbags secured with wood or steel stakes shall form the washout area barrier with a lining comprised of a minimum of 10 MIL polyethylene sheeting free of holes, tears, or other defects that compromise the impermeability of the material.
    b. Below grade temporary concrete washout facility: Lath and flagging at the perimeter of the lined area shall be commercial type anchoring and marking three sides of the basin comprised of a minimum of 10 MIL polyethylene sheeting free of holes, tears, or other defects that compromise the impermeability of the material. Sandbags shall be spaced around the perimeter of the lined area to hold the lining in place.
5. Washout of concrete trucks shall be performed in designated areas only. Only concrete from mixer chutes shall be washed into concrete wash out.
6. Once concrete wastes are washed into the designated area and allowed to harden, the concrete shall be broken up, removed, and disposed of on a regular basis.
7. When temporary concrete washout facilities are no longer required for the work, the hardened concrete shall be removed and disposed of. Materials used to construct temporary concrete washout facilities shall be removed from the site of the work and disposed of. Holes, depressions, or other ground disturbance caused by the removal of the temporary concrete washout facilities shall be backfilled and repaired.

H. Fuel and Chemical Handling:

1. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
2. Take special measures to prevent chemicals, fuels, oils, oil filters, greases, herbicides, and insecticides from being disposed of, spilled, or entering drainage ways.
3. Do not allow water used in onsite material processing, concrete curing, and other waste waters to enter a drainage way(s) or stream.
4. Spilled material and resulting contaminated soils shall be removed and disposed of in accordance with applicable regulations.
5. Contractor to pay all regulatory and Owner incurred costs resulting from improper discharges and corrective actions.

I. Control of Dust:

1. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.
    a. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants.
    b. The use of chemical agents such as calcium chloride must be approved by the State of Iowa DOT and Owner.
2. The Engineer will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.
3. Water shall be applied by means of pressurized water truck or similar equipment, equipped with a spray system or hoses with nozzles that will ensure a uniform application of water.
    a. A daily log shall be maintained and provided to MWA each month. The log shall identify the amount of water applied, which roads applied to, and dust additive included.

J. Burning: Do not burn material on the site.

K. Control of Noise:

1. Control noise by fitting equipment with appropriate and properly functioning mufflers.

L. Equipment Maintenance and Decontamination:

1. Waste oils, fuels, lubricants and filters shall be contained and removed from site. Disposal at the landfill is not allowed.
2. Open oil containers exposed to rain shall not be permitted and all spills shall be reported to the Owner immediately.
3. All vehicles and equipment entering the limits of construction and contacting potentially hazardous materials shall be cleaned and/or decontaminated prior to leaving the site. The Contractor shall be responsible for monitoring all vehicle equipment decontamination activity.
4. Decontamination area and fluid management shall be identified in the Contractor's health and safety plan.

M. Traffic Controls:

1. Provide all necessary controls, flagmen, signage and warning necessary to prevent impacts to landfill site users and off-site roadways, if utilized.
2. Traffic control plan is subject to Owner's approval.
3. Implement all necessary control measures.
4. Minimize number and frequency of crossing of access road to landfill.
5. Repair all damage as a result of traffic crossing.
6. Maintain conditions of existing access and haul roads on the site and adjacent facilities such that access is not hindered as the result of construction related activities or deterioration.
    a. Submit traffic control plan where crossing or excavation of existing roads is anticipated and include services of flagmen as required to coordinate crossings.

N. Leachate Management:

1. When the work involves or disturbs areas containing leachate or pipelines for the conveyance of leachate, the Contractor shall be required to manage leachate generated from the site and the site leachate conveyance system until the leachate conveyance system is complete and accepted by the Owner.
2. Proper management is considered an important aspect of Project and Contractor's responsibility.
    a. Management shall include collection, pumping, handling and transfer to the on-site leachate treatment facility.

1) Contractor shall identify construction operations that may encounter leachate and employ adequate means ahead of time to control and collect the flow of leachate such as plastic lined sumps and berms, pipe plugs, and absorbent booms.
2) Contractor shall provide and maintain throughout construction adequate portable pumps and temporary storage containers to be on standby at each construction operation that may encounter groundwater or stormwater.
3) Coordinate transfer with the Owner.
4) Management may also include temporary on-site storage in an environmentally acceptable manner (e.g., tank(s)) prior to transfer to the on-site leachate treatment facility.

3. Provide control measures to ensure that leachate is not discharged to any surface waters.
4. Leachate generation can be highly variable.
   a. Contractor should anticipate and plan for peaks in generation.
   b. Management activities are a seven (7) day per week, 24 HR per day requirement.
   c. Contractor shall grade and maintain access to leachate collection points to allow for access at all times.
   d. Periods of high precipitation and snow melt also tend to be periods of high leachate generation.
5. Any leachate spillage resulting from Contractor management activities shall be cleaned up immediately. Clean-up may include soil excavation and ground restoration. All costs of clean-up shall be at Contractor's expense without additional compensation.
6. Non-compliance with these requirements will result in Owner hiring a third-party to complete leachate management during construction at Contractor's sole cost.

O. Completion of Work:

1. Upon completion of work, leave area in a clean, natural looking condition.
2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed.

P. Historical Protection: If during the course of construction, evidence of deposits of historical or archeological interest is found, the Contractor shall cease operations affecting the find and shall notify the Owner.

1. No further disturbance of the deposits shall ensue until the Contractor has been notified by the Owner that Contractor may proceed.
2. The Owner will issue a notice to proceed after appropriate authorities have surveyed the find and made a determination to the Owner.
3. Compensation to the Contractor, if any, for lost time or changes in construction resulting from the find, shall be determined in accordance with changed or extra work provisions of the Contract Documents.
4. The site has been previously investigated and no known history of historical or archeological finds present in the Work areas.

END OF SECTION

SECTION 01 45 33

CODE-REQUIRED SPECIAL INSPECTIONS AND PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contractor responsibilities for code-required Special Inspections and testing.
2. Special Inspection program and reporting requirements.
3. Attachment A to this Section includes requirements for submittal of Special Inspections.
4. Attachment B to this Section includes Special Inspector qualifications, reporting requirements, and material specific Special Inspections and tests.
    a. Attachments A and B are for the Contractor's reference only and are not part of the Contract Documents.
    b. Attachments A and B are included to assist Contractor in understanding the Owner-provided services so the effect of such services may be factored into the Contractor's pricing and Progress Schedule.
    c. The Testing Agency and Special Inspector(s) performing the Owner-furnished services will be identified following the Effective Date of the Contract, unless otherwise identified in Section 01 11 00 - Summary of Work.

B. Purpose:

1. This Section and its attachments were developed to address the requirements of the 2015 edition of the International Building Code, IBC section 1704.1 and applicable amendments, if any, by authorities having jurisdiction.
    a. One or more Special Inspectors will be retained by Owner or Owner's consultant to perform Special Inspections on the types of Work addressed by the applicable building code under Section 1704.
2. One or more Special Inspectors or Testing Agencies will be retained by Owner or Owner's consultant to perform Special Inspections and tests for the types of Work indicated in the building code.
3. A Statement of Special Inspections will be submitted to the Building Code Official as a condition for issuance of applicable permit. This statement is included as Attachment A to this Section. Attachment B indicates a complete list of materials and Work requiring Special Inspections, required Special Inspections and the minimum qualifications of the Testing Agencies and Special Inspectors.
4. Special Inspections performed by entities retained by Owner or and entity for whom Owner is responsible are for benefit of Owner, Engineer, RDPRC, and Building Code Official. Contractor, together with Subcontractors and Suppliers, are not intended beneficiary of Special Inspections.

C. Related Requirements: Include, but are not necessarily limited to, the following:

1. Section 03 05 05 - Concrete Testing and Inspection.
2. Section 03 15 19 - Anchorage to Concrete.
3. Section 05 50 00 - Metal Fabrications.
4. Section 31 23 00 - Earthwork.

1.2 REFERENCES

A. Definitions:

1. The following defined terms, indicated in this section with initial capital letters, have the meaning assigned below, which apply to the singular and plural thereof:
    a. “Building Code Official” means officer (or their subordinate) having appropriate jurisdiction and authority charged with ministering and enforcing the building code in effect at the Site, or their duly authorized representative.
    b. “Registered Design Professional in Responsible Charge” (RDPRC) means the licensed and registered design professional who is responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the facility.
    c. “Soils Engineer” or “Geotechnical Engineer” means a Special Inspector engaged for the specific purpose of performing specialized Special Inspections relative to subgrade conditions, fill, special foundations, or a combination of these. “Soils Engineer” or “Geotechnical Engineer”, when used relative to Special Inspections, is an entity separate from Engineer. Relative to the Division 31 Specifications, for the purposes of Special Inspection "Soils Engineer," "Geotechnical Engineer," and "Special Inspector" have the same meaning.
    d. “Special Inspections” means inspection of specific elements of the Work requiring the expertise of an approved special inspector for compliance with the building code and the Contract Documents. Elements requiring special inspection are identified within this Section or elsewhere in the Contract Documents. Materials, mechanical, performance, and other testing required by the contract in other Specification sections, but not listed in this Section, are not part of the special inspections program.
    e. “Special Inspector” means representative of the Owner approved inspection entity designated for that portion of the Work.
    f. “Statement of Special Inspections” means document provided to the Building Code Official outlining special inspections and tests to be done on the Project and frequency of required tests.
    g. “Testing Agency” means approved entity, not affiliated with or hired by the Contractor, and responsible for the materials testing requirements of the Project including but not limited to concrete cylinder breaks, soils testing, and masonry materials testing. Testing Agency does not include any testing entity or laboratory retained by Contractor, Subcontractor, or Supplier either for tests that are Contractor’s responsibility in accordance with the Contract Documents but are not required by the building code, or test performed for Contractor’s convenience and information.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Meetings:

1. Attend and participate in preconstruction conference to review and coordinate responsibilities for inspection and testing procedures and requirements, as well as other preconstruction conference topics indicated in Section 01 31 19 - Project Meetings. Relative to this Section, in addition to required attendees indicated in Section 01 31 19 - Project Meetings, required conference attendees include: Owner, Testing Agency and Special Inspectors, Building Code Official, Engineer, and Contractor, together with appropriate Subcontractors and Suppliers.
2. Attend and participate in construction progress meetings prepared to discuss matters related to coordination and cooperation with Testing Agency and Special Inspectors, defective Work, and other topics indicated for construction progress meetings in Section 01 31 - Project Meetings.

1.4 CONTRACTOR'S RESPONSIBILITIES REGARDING SPECIAL INSPECTIONS

A. Contractor's Responsibilities Regarding Special Inspections – General.

1. Coordinate and cooperate with Testing Agency personnel, Special Inspectors, and employees and agents of Building Code Official.
2. Provide means to obtain and handle samples taken on site.
3. Provide storage facilities for testing agencies exclusive use as described in the Contract Documents.
4. Special Inspection is Owner's independent quality control. Special Inspections do not, in any way, reduce or mitigate Contractor's responsibilities for quality assurance, quality control, workmanship, complying with the Contract Documents, correction period or warranties. Contractor's own personnel shall review all Work requiring Special Inspections for compliance with the Contract prior to calling for the inspection.

B. Advising Testing Agency and Special Inspectors of Need for Services:

1. Not less than 24 hours prior to the need for Special Inspection or code-required testing or sampling, advise Testing Agency of Special Inspector, as applicable, in writing of Work for which Special Inspections or testing is required, indicating approximate time the Work will be ready for such inspection, testing, or sampling.
2. When Special Inspection, testing, or sampling is necessary on a Monday or day following a holiday, furnish such written advisory not less than the prior business day.

C. Work for which Special Inspections are required shall remain accessible and exposed for the purposes of Special Inspections until completion of required Special Inspections.

D. Work to be inspected shall be complete at time of Testing Agency's or Special Inspector's, as applicable, arrival at the Site.

E. Work that is defective shall be corrected and re-inspected. Such portions of the Work shall not be covered or concealed until authorized by Engineer.

F. Payment for Special Inspection services will be in accordance with the following:

1. Payment indicated below is for the Testing Agency and Special Inspector costs and does not include the Contractor's costs listed in Paragraph 1.4 A of this Section.
2. Work is Satisfactory: After Contractor notification of Testing Agency or Special Inspector, as applicable, inspector arrives at the Site and performs inspection within the timeframe indicated in Paragraph 1.4.F.4 below, and inspection reveals work is satisfactory, then Owner will pay for the associated Special Inspection. Contractor's eligibility for payment for the associated Work shall be in accordance with the Contract Documents.
3. Work initially defective but remedied in timely manner: After Contractor notification of Testing Agency or Special Inspector, as applicable, inspector arrives at the Site and performs inspection within the timeframe indicated in Paragraph 1.4.F.4 below, and inspection reveals work is defective, and the defective Work is remedied in accordance with the Contract within the period indicated in Paragraph 1.4.F.4, below, and the subject work is re-inspected and subsequently determined to be in accordance with the Contract, then Owner will pay for the associated Special Inspection. Contractor's eligibility for payment for the associated Work shall be in accordance with the Contract Documents.
4. Work not ready for inspection upon Special Inspector arrival: After Contractor notification of Testing Agency or Special Inspector, as applicable, inspector arrives at the Site and the Work is not ready for the associated inspection when inspector arrives, then inspector will remain on-site for a maximum of two hours awaiting the completion of the Work. If the subject Work is not ready for inspection at the end of this period, inspector will be dismissed until Contractor requests re-inspection. All costs associated with this inspection trip, including onsite time and travel time and expenses, will be Contractor's responsibility. Owner may set-off such amounts from payments due Contractor under the Contract.
5. Work initially defective and attempted remedy is also defective: After Contractor notification of Testing Agency or Special Inspector, as applicable, inspector arrives at the Site and

performs the inspection within the period indicated in Paragraph 1.4.F.4 of this Section, but inspection reveals defective Work, and Contractor attempts remedy and requests re-inspection within two hours, and the reinspection also reveals defective Work, inspector will be dismissed until Contractor requests re-inspection. All costs associated with this inspection trip, including onsite time and travel time and expenses, will be Contractor's responsibility. Owner may set-off such amounts from payments due Contractor under the Contract.

6. Work determined to be defective is in eligible for payment by Owner. Contractor is fully responsible for costs and time impacts of performing remedies so that the Work complies with the Contract Documents. Unless otherwise indicated in the Contract Documents, when re-inspection is necessary, Contractor is responsible for re-inspection costs, including onsite time, travel time and expenses, and other associated costs, if any. Owner may set-off such amounts from payments due Contractor under the Contract.

1.5 REPORTING DUTIES AND AUTHORITY

A. Reporting:

1. Testing Agency and Special Inspectors will furnish to RDPRC and Engineer written results of Special Inspections promptly after performance of such tests and inspections. When acceptable results are indicated, Contractor may obtain copies thereof from Engineer.
2. Reporting of Defective Work:
   a. Testing Agency and Special Inspectors will report defective Work to Contractor, Engineer, and RDPRC promptly.
   b. Defective Work that has been covered up or concealed prior to re-inspection will be reported by RPDRC to Engineer and Building Code Official.

B. Limitations on Authority of Special Inspectors and Testing Agencies:

1. Special Inspector and Testing Agencies expressly do not have authority for:
   a. Ordering, stopping, or suspending the Work.
   b. Modifying the requirements of the Contract Documents.
   c. Accepting defective Work.
   d. Directing the Contractor's, means, methods, techniques, sequences, or procedures of construction.
   e. Directing or advising on Contractor's safety programs or measures for safety and protection.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. Attachments: The following, bound after this Section's "End of Section" designation, are furnished for Contractor's reference but are expressly not part of the Contract Documents.

1. Attachment A - Submittal of Special Inspections, (one page).
2. Attachment B - Special Inspections, Inspector Qualifications and Reporting Requirements, (five pages).

END OF SECTION

ATTACHMENT A TO SECTION 01 45 33

SUBMITTAL OF SPECIAL INSPECTIONS

Statement Date: June 14th, 2024

Project Name: Metro Park West Scale House Design
Site Address: 2499 337th Street, Perry, Iowa 50220
Owner: Metro Waste Authority
Registered Design Professional in Responsible Charge (RDPRC): Svein Magnussen

The Statement of Special Inspections (Statement) is submitted as a condition for permit issuance in accordance with the Special Inspection requirements of the building code. The Special Inspection program is outlined in Specifications Section 01 45 33 – Code-Required Special Inspections and Procedures, including its Attachments A and B. A detailed explanation of the requirements for Special Inspections and Testing are indicated in Specifications Section 01 45 33 in conjunction with Specifications for each material and construction work result governed by the applicable building code.

Monthly Special Inspection reports will be submitted to the RDPRC and the Building Code Official. Apparent defective Work will be brought to the immediate attention of the Contractor for correction. If the defective Work is not corrected, the defective Work will be brought to the attention of the RDPRC and Engineer. Only documents that are prepared and signed or sealed by the Special Inspectors (SI) are valid.

The SI is responsible for verifying all information on each document prior to signing or sealing and directly forwarding it to the RDPRC and Engineer. The RDPRC will furnish to Building Code Official results of Special Inspections indicating acceptable results, unless Building Code Official directs that reports indicating unacceptable results also be furnished to the Building Code Official. The SI is responsible for verifying all inspectors under its supervision maintain current, valid certifications for the duration of the Project's construction. At the conclusion of each individual Special Inspection type, the SI will complete a Final Report.

The Special Inspection program does not relieve the Contractor or any other entity of any contractual duties, including quality control, quality assurance, or safety and protection. The Contractor is solely responsible for construction means, methods, techniques, procedures and sequences and associated safety and protection, and for complying with the Contract Documents. Failure to comply with the SI program as outlined herein may result in a stop work notice being issued by the Building Code Official.

Respectfully submitted,
Design Professional in Responsible Charge,

Svein Magnussen

Type or Print Name

Iowa License # 23213
Expires: 12/31/2025

Svein Magnussen — 6/14/2024

Signature — Date

END OF ATTACHMENT A

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ATTACHMENT B TO SECTION 01 45 33

SPECIAL INSPECTIONS, INSPECTOR QUALIFICATIONS AND REPORTING REQUIREMENTS

PART 1 - GENERAL

1.1 QUALIFICATIONS

A. Qualifications stated here are the minimum recommended by the RDPRC. If the Building Code Official has more stringent qualifications, the more stringent qualifications will take precedence.

B. All Special Inspections and testing will be done under the direction of a professional engineer or registered architect licensed and registered in the State of Iowa herein referred to as Registered Professional for Special Inspections (RPSI), who will be employed by or retained by Testing Agency or other entity furnishing Special Inspectors.

C. Soil, concrete, masonry, mortar, grout, steel and aluminum related testing.

1. The Testing Agency shall have a minimum of 10 years experience in the testing of the materials indicated.
2. The Testing Agency's technician(s) performing such testing:
    a. Shall have a minimum of five years experience in the testing of soil, concrete, mortar, grout, steel and aluminum as appropriate.
3. Concrete Related Work:
    a. International Code Council certification for Reinforced Concrete and American Concrete Institute Concrete Field Testing Technician – Grade 1.

D. Structural Special Inspections:

1. Professional engineers or architects, licensed and registered in the State of Iowa, may perform Special Inspections in accordance with their licensure.
2. Other individuals, working under the direct supervision of a licensed, registered, professional engineer or architect and possessing the following qualifications, may perform Special Inspections.
3. Soils Related Work:
    a. NICET Level II Certification in geotechnical engineering technology/construction; or
    b. Professional geologist licensed and registered in the same jurisdiction as the Site; or
    c. Engineer intern, also known as an Engineer in Training (EIT) (i.e., a person who has successfully passed the EIT exam that is part of the overall process of becoming a licensed, registered professional engineer, serving under the direct supervision of professional engineer licensed and registered in the same jurisdiction as the Site).
4. Concrete Related Work:
    a. International Code Council certification for Reinforced Concrete Special Inspector or American Concrete Institute Concrete Construction Special Inspector.
    b. Alternatively, may be an engineer intern/EIT under the direct supervision of a professional engineer licensed and registered in the same jurisdiction as the Site.
5. Other equivalent certifications are unacceptable unless approved by Engineer.

1.2 REPORTING DUTIES AND AUTHORITY

A. Reporting requirements for Special Inspector in accordance with the applicable building code for Building System Related Work.

1. Comply with requirements of applicable building code Section 1704.2.4.
2. Provide written documentation of all inspections and testing, including results, performed by Testing Agency and Special Inspectors.
    a. Indicate exact location of the subject Work.

b. If testing of specimens is performed, include detailed information on storage and curing of specimens prior to testing.

3. Furnish inspection and test reports to Contractor, RDPRC, and Engineer.
   a. Expressly indicate whether the Work inspected was performed in accordance with the Contract Documents.
   b. Immediately report defective Work to Contractor, RDPRC, and Engineer.
   c. If the defective Work is not remedied promptly, notify RDPRC and Engineer.
4. Issue a report, as an Electronic Document, summarizing all inspections, corrective action notifications and resolution of defective Work every 14 days.
   a. Furnish reports to:
      1) Engineer's project manager.
      2) Owner.
      3) Building Code Official.
      4) Contractor.
5. Prior to requesting inspection for Substantial Completion, the RDPRC shall compile all test reports for each inspected material and work result for each Special Inspector and summarize in a single Electronic Document (as a PDF file) and submit to Engineer and Building Code Official.
   a. Final summary report shall be sealed and signed by the RDPRC, who shall be licensed and registered in the same jurisdiction as the Site for Special Inspections stating:
      1) The required Special Inspections have been performed.
      2) All defective Work has been remedied to comply with the Contract Documents except as specifically indicated in the summary report.

B. Special Inspector shall report all defective Work to Contractor, RDPRC, and Engineer promptly.
   1. Defective Work that has been covered up or concealed prior to re-inspection shall be reported to Engineer and RDPRC.

C. Special Inspector does not have authority to order stopping or suspending the Work or modify the requirements of the Contract Documents.

1.3 MATERIAL SPECIFIC SPECIAL INSPECTIONS AND TESTS

A. Material specific requirements for Special Inspection and testing are indicated in the Specifications listed below. Special Inspection and testing requirements are indicated in the associated Specifications section under "Source Quality Control", "Field Quality Control" or "Quality Assurance" as appropriate for each material.

1.4 SOILS

A. Special Inspections will be performed in accordance with applicable building code Section 1705.6 as required to determine that subgrades were prepared in accordance with the Contract Documents, and to verify the allowable soil bearing pressure, materials, compaction densities, trenching and backfill and compliance with the Contract Documents.

B. Inspection and testing requirements are indicated separately in the Division 31 Specifications and are indicated as being performed by the Geotechnical Engineer, Testing Agency, or Special Inspector.

1.5 CONCRETE

A. Special Inspection and testing will be performed in accordance with applicable building code Table 1705.3. Inspection is required for material verification, reinforcing steel size and layout, reinforcing steel mechanical splices, embedded bolts, concrete tests, concrete placement and curing, and waterstop installation.
   1. Inspections of welding of reinforcing shall be in accordance with AWS D1.4 and special inspector shall be qualified under AWS D1.4.

B. Inspection and testing requirements are indicated in Specifications Section 03 05 05 - Concrete Testing and Inspection, and Specifications Section 03 31 31 - Concrete Mixing, Jointing, Placing and Curing, and are indicated as the services to be performed by the Special Inspector or Testing Agency.

END OF ATTACHMENT B

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Temporary utilities including:
   a. Temporary sanitary facilities, including drinking water.
2. Support facilities including:
   a. Project identification and other temporary signs.
   b. Waste disposal services.
   c. Owner/Engineer’s Field Office.
   d. Other construction aids and miscellaneous services and facilities.
3. Protection including:
   a. Barricades, warning signs, and lights.
   b. Environmental protection.

B. Provide temporary facilities and controls required for construction activities except, if any, for facilities and controls indicated as provided by the Owner.

1.2 UTILITY USE CHARGES

A. Include cost or use charges for temporary facilities in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

1. Owner's construction forces.
2. Occupants of Project.
3. Engineer.
4. Testing agencies.

B. Pay sewer service use charges for sewer usage (portable toilet), by all parties engaged in construction, at Project site.

1.3 QUALITY ASSURANCE

A. Comply with industry standards and with applicable laws and regulations of authorities having jurisdiction, including but not limited to the following:

1. Health and safety regulations.
2. Utility company regulations.
3. Police, fire department and rescue squad rules.
4. Environmental protection regulations.
5. NFPA 241 "Standards for Safeguarding Construction, Alterations and Demolition Operations".
6. ANSI-A10 Series standards for "Safety Requirements for Construction and Demolition".
7. NECA Electrical Design Library "Temporary Electrical Facilities", NFPA 70, and NEMA, NECA and UL standards and regulations for temporary electric service.

B. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.4 PROJECT CONDITIONS

A. At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

B. The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:

1. Keep temporary services and facilities clean and neat.
2. Relocate temporary services and facilities as required by progress of the Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Provide undamaged materials in serviceable conditions and suitable for use intended.

2.2 EQUIPMENT

A. Provide undamaged equipment in serviceable conditions and suitable for use intended.

B. Provide temporary self-contained toilet units of temporary single-occupant toilet units of the chemical, aerated recirculation, or combustion type for use by all construction personnel.

1. Units shall be supplied at both the Owner/Engineer office trailer location and the Contractor office trailer or staging and laydown area.
2. Units shall be properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
3. Units shall be fully secured to avoid tipping or otherwise causing release to the environment.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve the Project adequately and result in minimum interference with performance of the Work.

1. Relocate and modify facilities as required.

B. Provide each facility ready for use when needed to avoid delay.

1. Maintain and modify as required.
2. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

C. Temporary Sanitary Facilities:

1. Provide for toilets, wash facilities and drinking water fixtures in compliance with regulations and health codes for type, number, location, operation and maintenance of fixtures and facilities.
2. Provide toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility and provide covered waste containers for used materials.
3. Install separate self-contained toilet units for male and female personnel shielded to ensure privacy.
4. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for a healthy and sanitary condition.
    a. Dispose of drainage properly.
    b. Supply cleaning compounds appropriate for each condition.
5. Provide drinking water fountains or containerized tap-dispenser bottled-drinking water units, complete with paper cup supplies.

D. Storm Water Controls:

1. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of storm water from heavy rains.

2. Provide erosion control facilities required to prevent eroded soil from leaving the Site.
    a. See Drawings for erosion control features provided by Contractor and existing features provided by Owner.
3. Prevent storm water runoff from construction areas and other designated areas from ponding or leaving the property. Promote positive drainage.
    a. Provide and maintain full time stand-by pumping equipment to remove storm water accumulation at the temporary excavations, riser pipes, trenches or other approved systems.

3.2 TEMPORARY SUPPORT FACILITIES

A. Locate field offices, sanitary facilities and other temporary construction and support facilities for easy access.

B. Dewatering Facilities and Drains:

1. Comply with dewatering requirements of applicable Specification Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities.
2. Where feasible, use same facilities provided for the construction activities.
3. Maintain site, excavation and construction free of standing water.

C. Temporary Enclosures:

1. Provide temporary enclosures when appropriate for protection of construction, in progress or completed, from exposure, inclement weather, other construction operations and similar conditions.

D. Project Identification and Other Temporary Signs:

1. Locate signs where best to inform public and instruct persons seeking entrance to the project.
2. Support signs on posts or framing of steel or preservative-treated wood.
3. Engage an experienced sign painter to apply graphics.
4. Prepare and install signs to provide directional information to construction personnel, deliveries, and visitors.
5. Do not permit installation of unauthorized signs.
6. Fabricate and erect within 10 days following the Notice to Proceed.
7. Maintained in clean and neat condition throughout construction.
8. Remove and appropriately disposed of the sign when directed by Owner.

E. Contractor's Superintendent's Field Office:

1. Establish at site of Project.
    a. Location subject to Owner's approval.
2. Assure attendance at this office during the working times.
3. At this office, maintain complete field file of Shop Drawings, posted Contract Drawings and Specifications, and other files of field operations including provisions for maintaining "As Recorded Drawings."
4. Remove field office from site upon acceptance of the entire work by the Owner.

3.3 TEMPORARY PROTECTION FACILITIES

A. Temporary Fire Protection:

1. Comply with NFPA 10 "Standard for Portable Fire Extinguishers" and NFPA 241 "Standard for Safeguarding Construction, Alterations, and Demolition Operations".
2. Store combustible materials in containers in fire-safe locations.

3. Provide supervision of welding operations, combustion-type temporary heating units and other sources of fire ignition.

B. Barricades, Warning Signs, and Lights:

1. Comply with standards and code requirements for erecting structurally adequate barricades.
2. Paint with appropriate colors, graphics, and warning signs to inform personnel and the public of the hazard involved.
3. Where appropriate and needed, provide lighting, including flashing red or amber lights.

C. Security Enclosure and Lockup:

1. Install substantial temporary enclosure of partially completed areas of construction.
2. Create and install all enclosures, barricades and structures necessary to prevent access to trenches, fall hazards, excavations, pooled water or similar areas.
3. Provide a secure lockup for valuable stored materials and equipment.
4. Enforce discipline in connection with the installation and release of material to minimize the opportunity for theft and vandalism.

D. Owner/Engineer's Field Office:

1. Establish at Metro Park West Landfill at location indicated on Drawings.
2. Separate from Contractor's field office.
3. General construction:
    a. Mobile office trailer as manufactured by Satellite Co., Acton, or approved equal.
    b. Interior paneling.
    c. Vinyl tile floor covering in office area.
    d. Aluminum exterior.
    e. One (1) private office area and one (1) lockable storage area accessible from exterior and interior of unit.
    f. Windows:
        1) Minimum two (2) per room, with one (1) each on opposing walls.
        2) Combination screen-storm windows.
        3) Provide horizontal louver blinds on each window.
    g. Nominal 26 FT long and 8 FT wide (minimum, equivalent to Satellite Model 830MO or similar).
    h. Minimum two (2) exterior doors for office.
        1) All exterior doors to have cylinder deadbolt locks.
        2) All exterior doors to have exterior stairs and railings.
4. Electrical System:
    a. All fixtures, outlets, and wiring of Underwriters Laboratories, Inc. (UL) approved devices.
    b. All circuits protected by circuit breakers; fuses are not acceptable.
    c. Electrical system shall meet requirements of the latest National Electric Code (NEC).
    d. Any transformers or other devices required shall be provided and connected.
    e. Provide a circuit breaker for the incoming service.
    f. Each interior room shall have at least two (2) 110V duplex electrical convenience outlets.
5. Electric Heating and Air-Conditioning System suitable for local climate and four seasons.
    a. System to be capable of maintaining 75 DEGF constant temperature in office room.
6. Lighting System:

a. Fluorescent type ceiling light fixtures of ample quantity and quality to ensure adequate lighting throughout office and storage area.

7. Furnishings:
   a. One (1) built-in desk with pencil drawer.
   b. One (1) plan table 36 IN x 72 IN.
   c. One (1) 36 IN x 72 IN cork bulletin board. One (1) 48 x 60 IN liquid marking board with minimum four-color set of compatible markers.
   d. One (1) two-drawer legal size filing cabinet.
   e. One (1) nominal 3 FT plan racks that hold a 30 IN minimum of six (6), 100 sheet sets of 30 x 42 IN Drawings.
   f. Two (2) cushioned swivel arm chairs.
   g. Two (2) folding metal chairs.
   h. Two (2) standard size waste paper baskets.
   i. One (1) standard size recycling basket.

1. Field Office Equipment:
   a. One (1) combination printer/scanner/copier: HP OfficeJet Pro7740.
      1) All units to be new and compatible with other communications systems.
      2) Printer/Scanner/Copier unit shall remain property of the Owner beyond completion of the project.
2. Internet Connection: Provide mobile hotspot high speed internet connection.
3. Maintenance:
   a. Contractor shall provide all maintenance and upkeep of trailer and equipment.
      1) Equipment breakdowns shall be repaired promptly.
   b. Janitorial service.
      1) Biweekly:
         a) Floor sweeping using dust suppressing compound.
         b) Wet mopping with floor detergent.
         c) Empty waste paper and recycling baskets.
      2) Inclement weather: Conduct weekly requirements on daily basis.
   c. Pay all utilities and communications costs.
   d. Maintain at least until Substantial Completion or until otherwise suspended by the Engineer. Remove field office from site upon acceptance of the entire work by the Owner.

3.4 OPERATION, TERMINATION, AND REMOVAL

A. Supervision:

1. Enforce strict discipline in use of temporary facilities.
2. Limit availability of temporary facilities to essential and intended uses to minimize waste and abuse.

B. Maintenance:

1. Maintain facilities in good operating condition until removal.
2. Protect from damage by freezing temperatures and other elements.
3. Maintain operation of temporary enclosures, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage or accidents.
4. Prevent water-filled piping from freezing.
5. Maintain markers for underground lines.
6. Protect underground lines from damage during excavation operations.

C. Termination and Removal:

1. Unless the Owner requests that a temporary facility be maintained longer, each temporary facility shall be removed when the need for its service has ended.

2. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with the temporary facility.
3. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
4. Materials and facilities that constitute temporary facilities are the property of the Contractor, except the Owner reserves the right to take possession of project identification signs.

END OF SECTION

SECTION 01 65 50
MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing the Contractor's selection of products for use in the Project.

1.2 DEFINITIONS

A. Definitions used in this Section are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties," "systems," "structure," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock.
2. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
    a. "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature that is current as of the date of the Contract Documents.
    b. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed or installed to form a part of the Work.
    c. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.3 MATERIALS - QUALITY ASSURANCE

A. It is the intent of these specifications to procure a quality product of the latest design by an established manufacturer.

1. All components of systems shall be engineered for long, continuous, uninterrupted service.
2. The cost of the equipment shall include all royalties and costs arising from patents and licenses associated with furnishing the specified equipment.

B. All materials shall be designed to withstand stresses encountered in continuous operation, fabrication and erection.

C. Material for which no Detailed Specifications are Given Shall:

1. Meet the particular industry standard for the material used.
2. Meet the specifications of ASTM, ANSI or SAE for metals and plastics as appropriate for the use intended.
3. Not be used unless it has previously been used for a like purpose for a sufficient length of time in the field or under field-simulated laboratory conditions to demonstrate its successful use.

D. Source Limitations:

1. To the fullest extent possible, provide products of the same kind from a single source.
2. When specified products are available only from sources that do not, or cannot, produce a quantity adequate to complete project requirements in a timely manner, consult with the Engineer to determine the most important product qualities to consider before proceeding.
    a. Qualities may include attributes, such as visual appearance, strength, durability, or compatibility.
    b. When a determination has been made, select products from sources producing products that possess these qualities, to the fullest extent possible.

E. Compatibility of Options:

1. When the Contractor is given the option of selecting between 2 or more products for use on the Project, the product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

1. Schedule delivery to minimize long-term storage at the site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Provide equipment and personnel to handle products by methods that avoid soiling or damage.
4. Deliver products to the site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
5. Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that quantities are correct, products are undamaged, and properly protected.
    a. Inform the Engineer or Owner before the inspection occurs, so that they may participate in the inspection if so desired.
6. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.
    a. Seals and labels shall be intact and legible.
7. Store products in accordance with manufacturer's instructions.
    a. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.
8. Store products subject to damage by the elements above ground, under cover in a weathertight enclosure, with ventilation adequate to prevent condensation.
    a. Maintain temperature and humidity within range required by manufacturer's instructions.
9. Arrange for fabricated items or products stored outside to be placed on sloped supports above the ground.
10. Items subject to deterioration shall be covered by weatherproof sheet covering which is ventilated to prevent condensation.
11. Store loose granular materials on solid surfaces that are well drained and prevent contamination by foreign matter.
12. Stacked items shall be suitably protected from damage by spacers or load distributing supports that are safely arranged.
    a. No metalwork (miscellaneous steel shapes and reinforcing steel) shall be stored directly on the ground.
    b. Pipe, fittings, and valves may be stored out of doors, but must be placed on wooden blocking.
    c. Piping, geosynthetics, and other synthetic-type materials shall be stored off the ground on pallets and protected from direct sunlight or as otherwise recommended by manufacturers.
13. Arrange for periodic inspection of stored materials to ensure that materials remain undamaged and are maintained under required conditions.
14. All shipment, delivery and storage charges shall be at the expense of the Contractor.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements:

1. Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, new at the time of installation.
2. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.

B. Standard Products:

1. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

C. Product Selection Procedures:

1. The Contract Documents and governing regulations govern product selection. Procedures governing product selection include the following:
    a. Proprietary Specification Requirements:
        1) Where Specifications name only a single “Proprietary” product or manufacturer, provide the product indicated.
        2) No “or-equals” will be permitted.
    b. Where Specifications name one or more products or manufacturers:
        1) Comply with the Contract Document provisions concerning “or-equals”.
    c. Descriptive Specification Requirements:
        1) Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the listed characteristics and otherwise complies with Contract Documents.
    d. Performance Specification Requirements:
        1) Where Specifications require compliance with performance requirements, provide products that comply with listed requirements and are recommended by the manufacturer for the application indicated.
        2) Manufacturer's recommendations may be contained in published product literature or by the manufacturer's certification of performance.
    e. Compliance with Standards, Codes, and Regulations:
        1) Where Specifications only require compliance with an imposed code, standard, or regulation, select a product that complies with the standards, codes, or regulations specified.
    f. Visual Matching:
        1) Where Specifications require matching an established Sample, the Engineer's decision will be final on whether a proposed product matches satisfactorily.
        2) Where no product available within the specified category matches satisfactorily and complies with other specified requirements, comply with provisions of the Contract Documents concerning "or-Equal" for selection of a matching product in another product category.
    g. Visual Selection:
        1) Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements.
        2) The Engineer will select the color, pattern, and texture from the product line selected.

PART 3 - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place, accurately located, and aligned with other Work.

1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

3.2 FIELD QUALITY CONTROL

A. Inspect Deliveries:

1. Inspect all products or equipment delivered to the site prior to unloading.
2. Reject all products or equipment that are damaged, used, or in any other way unsatisfactory for use on Project.

B. Qualifications of Manufacturer’s Field Personnel:

1. Personnel shall be authorized by the manufacturer to erect, start-up and initiate warranty of the Product provided.
   a. Personnel shall come to the site with the required tools and instruments.
   b. Personnel shall have full knowledge of Product to be furnished.
2. Failure to provide personnel with full qualifications shall be cause for service trip to be disqualified as part of the requirements and may be cause for reimbursement for costs incurred by the Owner due to services required for a qualified start-up inspection.

END OF SECTION

SECTION 01 71 23
FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Engineering surveys provided by the Owner's Representative or Quality Assurance Consultant.
2. Engineering surveys provided by the Contractor.
3. Profile and topography shown on the Drawings.
4. Record measurements and markers.

1.2 SUBMITTALS

A. Provide record measurements of facilities, preconstruction conditions, roads, surfacing, utilities, and structures, as installed.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 PREPARATION

A. Investigate and verify the existence and location of site improvements, utilities, and other existing facilities.

B. Before construction, verify the location of:
1. Invert elevations at points of connection of utilities, and underground electrical services.

C. Furnish information to the Engineer and the appropriate utility regarding conflicts that are necessary to adjust, move, or relocate existing utility structures, lines, services, or other utility appurtenances located in or affected by construction.

3.2 ENGINEERING SURVEYS PROVIDED BY THE OWNER'S REPRESENTATIVE

A. Prior to the start of construction, Owner will be responsible to establish or verify benchmarks for construction, at the locations shown on the Drawings or in the general vicinity of the Work.

B. Prior to start of construction, Owner will be responsible to undertake surveys or estimates required to establish basis of Unit Price Work, if necessary.

C. Quality Assurance surveys as Owner deems necessary to document compliance.

D. After the award of the Contract the Owner will, for Contractor's convenience, provide an electronic copy of the proposed Grades in AutoCAD (DWG) release 2020.
1. This will be provided for convenience only and will not be considered a part of the Contract Documents.
2. See General Conditions related to discrepancies between printed and electronic files and reuse of documents.
3. Elevations will require adjustment based on actual construction.

3.3 ENGINEERING SURVEYS TO BE PROVIDED BY THE CONTRACTOR

A. General:

1. Provide, locate, preserve and protect established construction reference stakes, benchmarks and control points.
2. Locate, preserve and protect property corners and section corner monuments.

a. If moved or destroyed due to Contractor activities, then replace in accordance with applicable regulations or requirements.

3. Provide additional construction staking as necessary to layout and complete construction.
4. Before beginning construction staking, verify the information shown on the Drawings or provided by the Owner's Representative, in relation to the established construction reference stakes, benchmarks, control points and property corners.
   a. Notify the Engineer of any discrepancies.
5. Remove Contractor installed construction reference stakes when directed by the Engineer.
6. Owner will provide a survey reference table for Contractor's convenience in establishing a clear and consistent survey point numbering system.
   a. This table shall not be construed as all-inclusive or as modifying Contractor's contractual survey requirements in any way.

B. Prior to the start of construction, Contractor will be responsible to complete a preconstruction survey in all anticipated work areas and provide to the Owner's Construction Quality Assurance Representative.

C. Gravity and Pressure Pipeline Systems:

1. Provide any intermediate construction reference points required to verify installation at the line and grade established and locate appurtenant structures.
2. Check the line and grade with the construction reference stakes at each pipe length.

D. Structural Fill, Controlled Fill, and Embankments:

1. Provide any intermediate construction reference points required to verify installation at the line and grade established and locate appurtenant structures.

E. Site Improvements:

1. Provide construction reference stakes for site improvements including roadways, (roadways, aggregate surfacing, grading, fill and topsoil placement, terraces, diversion berms, and utility lines, equipment racks, and grades.
2. Provide construction reference stakes for location and elevations of structures.

3.4 PROFILE AND TOPOGRAPHY SHOWN ON THE DRAWINGS

A. Contours, profiles, or points of the ground are shown on the Drawings.

1. These profiles and contours are reasonably correct, but are not guaranteed to be absolutely so, and together with any schedule of quantities are presented only as an approximation.
2. See also notes on Drawings for features not in contours or profiles.

3.5 RECORD MEASUREMENTS AND MARKERS

A. Provide record survey information of the as-constructed facilities showing the exact horizontal and vertical location of building components, pipelines, drain lines, storm water lines, buried utilities, structures, stabilization measures, and other facilities that are covered when construction is complete.

B. Contractor shall provide Owner the as-constructed survey contours conforming to the project coordinate system identified on the Contract Drawings in AutoCAD (DWG) release 2020 compatible x, y, z format, as well as DWF format and digital terrain model (DTM).

C. Record Drawings shall include information based on field surveys (x, y, z) for the following improvements, at a minimum:

1. Limits of roadway placement and components.
2. Elevation contours for the completed area(s), including bulk excavation and soil placement areas.
3. Provide construction coordinates for top of pipe at a minimum of 100 FT intervals, at all changes in grades, turns, and at coordinate points shown on the Drawings.

4. Elevations and horizontal locations for all piping, drains, cleanouts, risers, and structures (where required to be installed), including where piping changes in vertical and/or horizontal direction or elevation occur.
5. Erosion/sedimentation control systems.
6. Limits of aggregate including vertical and horizontal locations for all related improvements (where required to be installed).
7. Other improvements related to the Work as shown on the Drawings.

END OF SECTION

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SECTION 01 77 01
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion.
2. Final Completion.
3. Project Record Documents.
4. Warranties.
5. Instruction of Owner's personnel.
6. Final Cleaning.

1.2 SUBSTANTIAL COMPLETION

A. Before notifying Owner and Engineer that the Work is Substantially Complete, undertake the following:

1. Demonstrate to the Engineer that systems and system components operate as intended.
2. Advise Owner of pending insurance changeover requirements.
3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents, as appropriate.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Prepare and submit Project Record Documents, Engineering Surveys and Record Measurements and Markers as required by Section 01 71 23, and similar final record information.
6. Deliver any specified tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
7. Advise Owner's personnel of changeover in security provisions.
8. Complete startup testing of systems.
9. Submit any specified test/adjust/balance records.
    a. Coordinate and conduct an operating test of the completed systems and components of their work under normal full operating conditions of use.
    b. Make adjustments and replacements necessary to bring all work into compliance with the Contract Documents; all applicable codes, regulations and laws; and system manufacturer requirements.
    c. Operating systems and equipment shall be adjusted to provide smooth, unhindered operation satisfactory to the Owner.
10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
12. Complete final cleaning requirements, including touchup painting, including a thorough cleaning, of all work as appropriate to remove all foreign matter, spots, stains, and soil so as to put all work in a complete and finished condition.
13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

14. Cleaning and touch up shall be repeated as necessary until final completion of all punch list items.
15. Exterior cleaning shall include washing down and sweeping of all paved areas and removal of all trash and debris from the site.

B. After Owner acceptance, costs incurred by the Owner for cleaning attributable to work of the Contract will be charged to the Contractor.

C. Submit written notification to Owner and Engineer that the entire Work is ready for its intended use and the entire Work is substantially complete.

1. If the items in Paragraph A. above are complete, then within 14 days Owner, Contractor and Engineer will make an inspection of the Work to determine status of completion.
2. If Engineer considers the Work substantially complete, then Engineer will prepare and deliver to the Owner a tentative Certificate of Substantial Completion fixing the date of Substantial Completion with an attached tentative list of items to be completed or corrected before final payment.
3. Engineer will issue a definitive Certificate of Substantial Completion with list of items to be completed or corrected or notify Contractor that the Work is not substantially complete within 21 days after submittal to Owner.
4. The Contractor shall request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
5. Results of completed inspection will form the basis of requirements for Final Completion.
6. Costs associated with reinspections by the Engineer due to the work not meeting Substantial Completion requirements after Contractor notification shall be charged to the Contractor.
    a. See Supplementary Condition SC15.03.B.

1.3 FINAL COMPLETION

A. Preliminary Procedures:

1. Before requesting final inspection for certification of final payment, complete the following:
    a. Submit a list of items identified as requiring correction or completion.
        1) List exceptions in the request.
    b. Instruct Owner’s personnel in operation, adjustment and maintenance of products, equipment and systems in accordance with the Contract Document requirements.
    c. Submit the final payment request with releases and supporting documentation not previously submitted and accepted.
        1) Include insurance certificates for products and completed operations where required.
    d. Submit an updated final statement, accounting for final additional changes to the Contract Sum.
    e. Submit a written notice that the work is complete including a certified copy of the Engineer’s final inspection list of items to be completed or corrected, endorsed and dated by the Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Engineer.
        1) On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements.
    f. Submit consent of surety to final payment.
    g. Submit a final liquidated damages settlement statement.
    h. Submit evidence of final, continuing insurance coverage complying with insurance requirements.

i. Submit Project Record Documents, Record Measurements and Markers, Drawings, Project Manual, Operation and Maintenance Manuals, product test data and similar final record information.

j. Deliver tools, spare parts, extra stock and similar items.

B. Reinspection Procedure:

1. The Engineer will reinspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner and Engineer.
2. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance. If the work is incomplete, the Engineer will advise the Contractor of work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
3. If necessary, reinspection will be repeated.
   a. Costs associated with reinspections by the Engineer due to the work not meeting Final Completion requirements, after Contractor notification, shall be charged to the Contractor.
   b. See Supplementary Condition SC15.03.B.

1.4 PROJECT RECORD DOCUMENTS

A. General:

1. Do not use Record Documents for construction purposes.
2. Protect Record Documents from deterioration and loss in a secure, fire-resistant location.
3. Provide access to Record Documents for Engineer's reference during normal working hours.
4. See Section 01 71 23.

B. Record Drawings:

1. Furnish a complete set of Construction Document Drawings to be utilized by Contractor and all Subcontractors for recording all changes and variations from the Original Drawings and Shop Drawings.
   a. Mark the set to show the actual installation where the installation varies from the work as originally shown.
   b. Mark which Drawing is most capable of showing conditions fully and accurately.
   c. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings.
      1) Give particular attention to concealed elements that would be difficult to measure and record at a later date.
2. Mark record sets with red erasable pencil.
   a. Use other colors to distinguish between variations in separate categories of the work.
3. Mark new information that is important to the Owner but was not shown on Contract Drawings or Shop Drawings.
4. Note related Change Order numbers where applicable.
5. Organize Record Drawing sheets into manageable sets.
   a. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
6. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
7. Identify and date each Record Drawing; include designation "PROJECT RECORD DRAWING" in a prominent location.
8. Upon completion of the Work submit Record Drawings to the Engineer for the Owner's records.

C. Record Specifications:

1. Furnish a copy of the Project Manual for recording changes.
    a. Mark these documents to show substantial variations in actual work performed in comparison with the text of the Specifications and modification.
    b. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
    c. Note related Record Drawing information and product data.
    d. Identify and date Record Specification; include “PRODUCT RECORD SPECIFICATION” in a prominent location.
    e. Upon completion of the work, submit record specifications to the Engineer for the Owner’s records.

D. Record Product Data: Furnish one copy of each product data submittal. Note related Change Orders and markup of Record Drawings and Record Specifications.

1. Mark these documents to show significant variations in actual work performed in comparison with information submitted.
    a. Include variations in products delivered to the site and from the manufacturer’s installation instructions and recommendations.
2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
3. Upon completion of markup, submit complete set of Record Product Data to the Engineer for the Owner’s records.

E. Record Sample Submitted:

1. Immediately prior to Substantial Completion, the Contractor shall meet with the Engineer and the Owner’s personnel at the project site to determine which samples are to be transmitted to the Owner for record purposes.
2. Comply with the Owner’s instructions regarding delivery to the Owner’s sample storage area.

F. Miscellaneous Record Submittals:

1. Refer to individual specification sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work.
2. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order.
3. Identify miscellaneous records properly and bind or file, ready for continued use and reference.
4. Submit to the Engineer for the Owner’s records.

1.5 WARRANTIES

A. Submit written warranties for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.

B. Submit properly executed warranties of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.

1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8 1/2 by 11 IN (115-by-280-mm) paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty.

a. Mark tab to identify the product or installation.
b. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General:

1. Conduct final cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning:

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a 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.
   c. Remove petrochemical spills, stains, and other foreign deposits.
   d. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
   e. Remove tools, construction equipment, machinery, and surplus material from Project site.
   f. Remove all sediment from erosion control structures.
   g. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances.
   h. Remove debris and surface dust from limited access spaces, including vaults, manholes, pipes, and similar spaces.
   i. Sweep concrete floors broom clean in unoccupied spaces.
   j. Remove labels that are not permanent.
   k. Touch up and otherwise repair and restore marred, exposed finishes and surfaces.
      1) Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
      2) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
   l. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
   m. Replace parts subject to unusual operating conditions.
   n. Leave Project clean and ready for occupancy.

C. Comply with Safety Standards for Cleaning:

1. Do not discharge volatile, harmful, or dangerous materials on the site.
2. Properly and lawfully dispose of waste materials from Project site.

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DIVISION 02

EXISTING CONDITIONS

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SECTION 02 65 00
SOILS TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Soil testing as required to establish compliance with earthwork specifications and Contract Documents.
2. The Contractor shall conduct prequalification tests prior to furnishing off-site materials and prior to material placement.
3. Prequalification tests to verify compliance with required material properties as described herein.
4. Compliance tests to verify compliance with specifications described herein.

B. Related Sections include but are not necessarily limited to:

1. Division 00 - Procurement and Contracting Requirements.
2. Division 01 - General Requirements.
3. Section 01 71 23 - Field Engineering.
4. Section 31 23 00 - Earthwork.

1.2 RESPONSIBILITY AND PAYMENT

A. Contractor provides and pays for certain soil testing services as specified herein:

1. Contractor:
   a. Retain the services of a Testing Agency to perform testing services for the following:
      1) Testing of off-site and granular materials for prequalification and compliance with the Contract Documents.
      2) Additional testing or retesting of materials which fail to meet Specification.
      3) In-place testing as specified to confirm thickness and compliance.
      4) Production control soil testing if required to control quality of work.

B. Owner may conduct additional testing if desired.

C. Provide for Owner testing and assist where necessary in obtaining samples or preparing areas for testing.

1.3 QUALITY ASSURANCE

A. Referenced Standards:

1. Comply with applicable sections of the following reference standard(s) with respect to materials, workmanship, construction, and testing methods.
2. ASTM International (ASTM):
   a. C117, Standard Test Method for Materials Finer than 75-µm (No. 200) Sieve in Mineral Aggregates by Washing.

b. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

c. D422, Standard Test Method for Particle-Size Analysis of Soils.

d. D698, Tests for the Moisture Density Relations of Soils and Soil Aggregate Mixtures Using a 5.5 LB Rammer and a 12 IN Drop.

e. D1140, Standard Test Method for Materials Finer than 75 MM (No. 200) Sieve in Mineral Aggregate by Washing.

f. D2216, Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixture.

g. D2217, Practice for Wet Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants.

h. D2434, Standard Test Method for Permeability of Granular Soils (Constant Head).

i. D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

j. D4643, Standard Test Method for Determination of Water (Moisture) Content of Soil by the Microwave Oven Method.

3. Iowa Department of Transportation (IDOT):

a. Standard Specifications for Highway and Bridge Construction.

b. Test Method 408-A, Durability: Soundness.

1.4 DEFINITIONS

A. Testing Agency:

1. An independent professional testing firm or service hired by Contractor, and acceptable to the Owner, to perform testing and analysis services on materials, as provided in the Contract Documents.

2. The name and qualifications of the Testing Agency are to be presented in Contractor's list of subcontractors.

B. Prequalification Testing:

1. The Contractor's Testing Agency shall perform materials testing and analysis of on and off-site granular borrow soils to be used in the construction.

2. This testing and analysis shall be performed on soils and reported to Engineer prior to being incorporated into the work or transported to the project site.

C. Production Control and Compliance Testing:

1. The Contractor's Testing Agency shall perform materials testing and analysis on soil placed and compacted to verify property requirements described herein.

1.5 SUBMITTALS

A. Shop Drawings:

1. See Section 01 33 00.

2. Soil test data for prequalification testing shall be submitted to the Engineer at least 14 days prior to its intended use on the project.

3. Concrete test results including:

a. Slump.

b. Air Content.

c. Temperature.

d. Strength.

4. Soil data for prequalification testing shall consist of:

   a. Coarse Aggregate:

      1) Soil classification.

      2) Percent fines (passing No. 200 sieve).

      3) Grain size distribution and certification of compliance.

      4) Soundness in accordance with IDOT methods.

      5) Hydraulic conductivity.

   b. Field logs and locations of test excavations for off-site borrow soils noting:

      1) Depth.

      2) Soil type.

      3) Test sample locations.

      4) Total layer thickness.

      5) Other pertinent data.

   c. On-site borrow soils for use in structural fill:

      1) Atterberg Limits.

      2) Visual Classification.

      3) Percent fines (passing No. 200 sieve).

      4) Moisture-density relationship

5. Soil test data for compliance testing shall consist of:

   a. Coarse Aggregate:

      1) Sieve analysis.

      2) % Fines.

   b. Total thickness, as determined by Contractor survey:

      1) Structural fill.

      2) Roadway aggregate and surface coarse.

   c. Additional Contractor surveying beyond that identified in Section 01 71 23 may be used to complement thickness measurements.

   d. Excavations or borings in lieu of Contractor surveying at the sole discretion of Owner's Representative.

6. Contractor’s prequalification and compliance testing shall at a minimum meet the required frequencies within the Contract Documents.

7. All soil samples shall be held by Contractor's Testing Agency under constant moisture conditions for a minimum of 45 days after final submittal and approval of test results.

PART 2 - PRODUCTS - (NOT APPLICABLE TO THIS SPECIFICATION SECTION)

PART 3 - EXECUTION

3.1 SERVICES TO BE PERFORMED BY TESTING AGENCY

A. Evaluate and test Contractor's proposed materials for compliance with the Contract Documents prior to incorporation in the Work.

1. Submit results no later than 14 days prior to its proposed use at the site.

B. Prepare samples for Atterberg Limits and grain size analysis testing using ASTM D2217.

C. Conduct tests on soils for percentage of fines (passing No. 200 sieve) using ASTM D1140 (fine grained soils) or ASTM C117 (granular soils) and grain size distribution using ASTM D422 (fine grained soils) or ASTM C136 (granular soils).

D. In-place moisture and density, grain size, and other properties on material after placement and compaction.

E. Conduct moisture content tests on soils using ASTM D2216 or ASTM D4643.

3.2 FREQUENCY OF TESTING

A. The following types and frequency of prequalification and compliance testing shall be performed on each material and changed material type to be used for each soil layer:

1. Coarse Aggregate:

PARAMETER	TEST METHOD	FREQUENCY
Grain Size Distribution (drainage layer only)	ASTM C136	1 per 3,000 CY
Percent Fines (coarse aggregate only)	ASTM D422	1 per 3,000 CY
Aggregate Soundness	ASTM C88	1 per source

2. On-site soils used for Recompacted Clay Liner and Structural Fill:

PARAMETER	TEST METHOD	FREQUENCY
Prequalification Testing		
Atterberg Limits	ASTM D4318	1 per material type
Visual Classification	ASTM D2488	1 per material type
Percent Fines	ASTM D1140	1 per material type
Moisture Content	ASTM D2216 or D4643	1 per material type
Moisture-Density Relationship	ASTM D698 or D1557	1 per material type
Compliance Testing		
Atterberg Limits	ASTM D4318	1 per 3,000 CY
% Fines	ASTM D6913, ASTM D7928	1 per 3,000 CY
Moisture-Density Relationship	ASTM D698 or ASTM D1557	1 per 10,000 CY or as soil type changes
Density	ASTM D2922 or D1587	3 tests per 100-LF per 6-IN lift
Water Content	ASTM D3017 or D2216	3 tests per 100-LF per 6-IN lift

3. Density and water content test locations on the fill will be identified by Owner's CQA Consultant/Engineer.
4. Structural Fill and Access Road:
    a. Subgrade surface shall be compacted to specifications required for Structural Fill.
    b. Proofroll the exposed subgrade with a loaded tandem-axle dump truck weighing at least 34,000 LBS.
        1) Operate trucks at less than 10 MPH.
    c. Contractor's Testing Agency will observe proofrolling and define the acceptability of subgrade as well defining the extent of unsuitable soils.
    d. Owner's Quality Assurance Consultant shall be given the opportunity to observe subgrade proofrolling and to inspect subgrade below fill material both prior to and after subgrade compaction or stabilization.
    e. Unstable or unsuitable soils which are revealed by proofrolling, remove and replace with new compacted Structural Fill.
5. Additional tests should be performed on any suspect material observed by the Contractor or Engineer's Field Representative.
6. Frequency based on material meeting pre-qualifications.
    a. Perform additional tests if prequalification requirements are not satisfied.
7. Certain tests may be performed after soil type and suitability are established by other test methods.

3.3 OTHER TESTING SERVICES TO BE PERFORMED BY TESTING AGENCY AS NEEDED

A. Following services to be performed by Testing Agency when necessary, at no additional cost to Owner:
    1. Additional soil testing as required by the specifications. Contractor shall be responsible for quality control and quality assurance testing.
    2. Additional testing and inspection required because of changes or rejection of materials.
    3. Production quality control testing as Contractor may require for effective production of the Work.

3.4 DUTIES AND AUTHORITIES OF TESTING AGENCY

A. Testing Agency is to inspect, sample and test materials as required by these Contract Documents.
    1. Testing Agency to report all test and inspection results to Engineer and Contractor immediately after they are performed.
B. When it appears that any material furnished or work performed by Contractor fails to fulfill requirements of the Contract Documents, Testing Agency is to test suspect materials and to report findings to Engineer and Contractor.
    1. All test reports to include exact location and depth from which the material was taken and/or location of samples selected from in-place materials.
C. Limited Authority of Testing Agency:

1. Any Testing Agency or agencies and their representatives retained by Contractor are not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents, nor to reject, approve or accept any portion of the Work.

3.5 RESPONSIBILITIES AND DUTIES OF CONTRACTOR

A. Provide necessary testing services for prequalification of proposed materials and compliance testing upon placement.

B. Use of Testing Agency and results of tests on proposed materials shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

C. To facilitate testing and inspection, perform the following:

1. Furnish any necessary labor to assist the Testing Agency in obtaining and handling samples at site or other sources of materials.
2. Provide the Testing Agency adequate notice to obtain samples, test and report results prior to time of material placement.

END OF SECTION

DIVISION 03

CONCRETE

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SECTION 03 05 05
CONCRETE TESTING AND INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contractor requirements for testing of concrete and grout.
2. Definition of Owner provided testing.
3. Acceptance criteria for concrete.
4. Materials and concrete testing as required to establish concrete mix design.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 21 00 - Reinforcement.
2. Section 03 31 30 - Concrete, Materials and Proportioning.
3. Section 03 31 31 - Concrete Mixing, Placing, Jointing and Curing.

1.2 RESPONSIBILITY AND PAYMENT

A. Owner will hire an independent Testing Agency/Service Provider to perform the following testing and inspection and provide test results to the Engineer and Contractor.

1. Testing and inspection of concrete and grout produced for incorporation into the work during the construction of the Project for compliance with the Contract Documents.
2. Additional testing or retesting of materials occasioned by their failure, by test or inspection, to meet requirements of the Contract Documents.
3. Strength testing on concrete required by the Engineer or Special Inspector when the water-cement ratio exceeds the water-cement ratio of the typical test cylinders.
4. In-place testing of concrete as may be required by Engineer when strength of structure is considered potentially deficient.
5. Other testing services needed or required by Contractor such as field curing of test specimens and testing of additional specimens for determining when forms, form shoring or reshoring may re-removed.
6. Owner will pay for services defined in Paragraph 1.2A.1.

B. Hire a qualified testing agency to perform the following testing and provide test results to the Engineer.

1. Testing of materials and mixes proposed by the Contractor for compliance with the Contract Documents and retesting in the event of changes.
2. Additional testing and inspection required because of changes in materials or proportions requested by Contractor.
3. Pay for services defined in Paragraphs 1.2B.1. and 1.2B.2.
4. Reimburse Owner for testing services defined in Paragraphs 1.2A.2., 1.2A.3., 1.2A.4. and 1.2A.5.

C. Duties and Authorities of Testing Agency/Service Provider:

1. Any Testing Agency/Service Provider or agencies and their representatives retained by Contractor or Owner for any reason are not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents, nor to reject, approve or accept any portion of the Work.
2. Testing Agency/Service Provider shall inform the Contractor and Engineer regarding acceptability of or deficiencies in the work including materials furnished and work performed by Contractor that fails to fulfill requirements of the Contract Documents.

3. Testing Agency to submit test reports and inspection reports to Engineer and Contractor immediately after they are performed.
    a. All test reports to include exact location in the work at which batch represented by a test was deposited.
    b. Reports of strength tests to include detailed information on storage and curing of specimens prior to testing.
4. Owner retains the responsibility for ultimate rejection or approval of any portion of the Work.

1.3 QUALITY ASSURANCE

A. Referenced Standards:
    1. American Concrete Institute (ACI):
        a. 318, Building Code Requirements for Structural Concrete.
    2. ASTM International (ASTM):
        a. ASTM Cement and Concrete Reference Laboratory (CCRL).
        b. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
        c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
        d. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
        e. C94, Standard Specification for Ready-Mixed Concrete.
        f. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
        g. C172, Standard Practice for Sampling Freshly Mixed Concrete.
        h. C1019, Standard Test Method for Sampling and Testing Grout.
        i. C1218, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
        j. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Qualifications:
    1. Contractor’s Testing Agency:
        a. Meeting requirements of ASTM E329 and ASTM C94.
        b. Provide evidence of recent inspection by CCRL of NBS, and correction of deficiencies noted.

C. Use of Testing Agency and approval by Engineer of proposed concrete mix design shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

1.4 DEFINITIONS

A. Testing Agency/Service Provider: An independent professional testing/inspection firm or service hired by Contractor or by Owner to perform testing, inspection or analysis services as directed, and as provided in the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings:
    1. Product technical data including:
        a. Concrete materials and concrete mix designs proposed for use.
            1) Include results of all testing performed to qualify materials and to establish mix designs.
            2) Place no concrete until approval of mix designs has been received in writing.
            3) Submittal for each concrete mix design to include:
                a) Sieve analysis and source of fine and coarse aggregates.

b) Test for aggregate organic impurities.
c) Proportioning of all materials.
d) Type of cement with mill certificate for the cement.
e) Brand, quantity and class of fly ash proposed for use along with other submittal data as required for fly ash by Specification Section 03 31 30.
f) Slump.
g) Brand, type and quantity of air entrainment and any other proposed admixtures.
h) Shrinkage test results.
i) Total water soluble chloride ion concentration in hardened concrete from all ingredients determined per ASTM C1218.
j) 28-day compression test results and any other data required by Specification Section 03 31 30 to establish concrete mix design.

2. Certifications:
   a. Testing Agency qualifications.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 TESTING SERVICES TO BE PERFORMED SERVICE PROVIDER/TESTING AGENCY

A. The following concrete testing will be performed by the Service Provider/Testing Agency:

1. Concrete strength testing:
   a. Secure concrete samples in accordance with ASTM C172.
      1) Obtain each sample from a different batch of concrete on a random basis, avoiding selection of test batch other than by a number selected at random before commencement of concrete placement.
   b. For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
      1) Record any deviations from requirements on test report.
      2) Cylinder size: Per ASTM C31.
         a) 4 inches cylinders shall not be used for concrete mixes with maximum aggregate size larger than 1 inch.
         b) Use the same size cylinder for all tests for each concrete mix.
      3) Quantity:
         a) 6 inches diameter by 12 inches high: Fourcylinders.
         b) 4 inches diameter by 8 inches high: Six cylinders.
   c. Field cure one cylinder for the seven day test.
      1) Laboratory cure the remaining.
   d. Test cylinders in accordance with ASTM C39.
      1) 6 inches diameter cylinders:
         a) Test two cylinders at 28 days for strength test result and the one field cured sample at seven days for information.
         b) Hold remaining cylinder in reserve.
      2) 4 inches diameter cylinders:
         a) Test three cylinders at 28 days for strength test result and the one field cured cylinder at seven days for information.
         b) Hold remaining cylinders in reserve.
   e. Strength test result:

1) Average of strengths of two, 6 inches diameter cylinders or three, 4 inches diameter cylinders from the same sample tested at 28 days.
2) If one cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder(s); average strength of remaining cylinders shall be considered strength test result.
3) Should all cylinders in any test show any of above defects, discard entire test.

f. Frequency of tests:
1) Concrete sand cement grout: One strength test for each 4 hour period of grout placement or fraction thereof.
a) Test grout in accordance with ASTM C1019.
2) Concrete topping, concrete fill and lean concrete: One strength test for each 10CUYD of each type of concrete or fraction thereof placed.
3) All other concrete:
a) One strength test to be taken not less than once a day, nor less than once for each 60 cubic yards or fraction thereof placed in any one day.
b) Once for each 5000 square feet of slab or wall surface area placed each day
c) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five strength tests for each concrete mix, tests shall then be made from at least five randomly selected batches or from each batch if fewer than five batches are provided.

2. Slump testing:
a. Determine slump of concrete sample for each strength test.
1) Determine slump in accordance with ASTM C143.
b. If consistency of concrete appears to vary, the Engineer or Owner's Representative shall be authorized to require a slump test for each concrete truck.
1) This practice shall continue until three consecutive batches are determined to be consistent and meet the slump requirements specified.

3. Air content testing: Determine air content of concrete sample for each strength test in accordance with ASTM C231, ASTM C173, or ASTM C138.
4. In-place concrete testing (if required).

3.2 SPECIAL INSPECTIONS

A. See Section 01 45 33.
1. Special Inspections listed are for the Contractor reference only and is not part of the Contract Documents.
2. It is included to assist the Contractor in understanding the Owner-provided Services so that those services may be factored into the Contractor's pricing and schedule.

B. Formwork Special Inspections:
1. Shape, location, and dimensions.
a. Inspect in accordance with dimensions and details on Drawings.
b. Frequency: Inspect prior to each concrete pour.

C. Reinforcing Special Inspections:
1. Reinforcing size, spacing, lap length and concrete cover.
a. Inspect in accordance with Drawings and Specification.
b. Frequency: Inspect prior to each concrete pour.
2. Reinforcing adhesive anchoring system:
a. Inspect in accordance with ICC-ES report.
b. Frequency:

1) Inspect all adhesive anchors for the first 4 hours of installation.
2) Inspect approximately 25% of adhesive anchors thereafter.
3) Additional inspection will be required for different installer or if the quality of installation appears to vary.

D. Mixing, Placing, Jointing, and Curing Special Inspections:

1. Perform concrete tests per the requirements of this Specification Section.
2. Verification of proper mix design.
   a. Frequency: Periodically, prior to each concrete pour.
3. Proper concrete placement techniques.
   a. Inspect per requirements of Section 03 31 31.
   b. Frequency: During each concrete pour.
4. Proper curing temperature and techniques.
   a. Inspect per requirements of Section 03 31 31.
   b. Frequency: Periodically, but not less than every third day.
5. Joints:
   a. Inspect joints for proper joint type, dimensions, reinforcing, dowel alignment, surface preparation and location.
   b. Frequency: Prior to each concrete pour.

E. Anchorage to Concrete Special Inspection:

1. Post installed anchors as required by the building code, ICC-ES Evaluation Reports, and as specified by the Engineer.
   a. Frequency: Per ICC-ES Report.
2. Cast-in-place concrete anchors, including anchor size, embedment, material and location.
   a. Frequency: Prior to each concrete pour.

3.3 SAMPLING ASSISTANCE AND NOTIFICATION FOR OWNER

A. To facilitate testing and inspection, perform the following:

1. Furnish any necessary labor to assist Testing Agency in obtaining and handling samples at site.
2. Provide and maintain for sole use of Testing Agency adequate facilities for safe storage and proper curing of test specimens on site for first 24 hours as required by ASTM C31.
3. Take samples at point of placement into concrete member.

B. Notify Engineer and Owner's Testing Agency sufficiently in advance of operations (minimum of 24 hours) to allow for assignment of personnel and for scheduled completion of quality tests.

3.4 ACCEPTANCE

A. Completed concrete work which meets applicable requirements will be accepted without qualification.

B. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.

C. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Contract Documents.

1. In this event, modifications may be required to assure that concrete work complies with requirements.
2. Modifications, as directed by Engineer, to be made at no additional cost to Owner.

D. Dimensional Tolerances:

1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to modifications required by Engineer.
2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal.
    a. If removal of excess material is permitted, accomplish in such a manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.
3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or misplaced items interfere with other construction.
4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view, may be rejected.
    a. Repair or remove and replace if required.
5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or appearance is not adversely affected.
    a. High spots may be removed with a grinder, low spots filled with a patching compound, or other remedial measures performed as permitted or required.

E. Appearance:

1. Concrete surfaces exposed to view with defects which, in opinion of Engineer, adversely affect appearance as required by specified finish shall be repaired by approved methods.
2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in the opinion of the Engineer, the defects impair the long-term strength or function of the member.

F. High Water-Cement Ratio:

1. Concrete with water in excess of the specified maximum water-cement ratio will be rejected.
2. Remove and replace concrete with high water-cement ratio or make other corrections as directed by Engineer.

G. Strength of Structure:

1. Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to following:
    a. Low concrete strength:
        1) Test results for standard molded and cured test cylinders to be evaluated separately for each mix design.
            a) Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards.
            b) For evaluation of potential strength and uniformity, each mix design shall be represented by at least three strength tests.
            c) A strength test shall be the average of two, 6 inches diameter cylinders or three, 4 inches diameter cylinders from the same sample tested at 28 days.
        2) Acceptance:
            a) Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:
                (1) Average of all sets of three consecutive strength tests equal or exceed the required specified 28 day compressive strength.
                (2) No individual strength test falls below the required specified 28 day compressive strength by more than 500 psi.

b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at variance with requirements in Specification Section 03 21 00 or requirements of the Contract Drawings or approved Shop Drawings.

c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.

d. Curing time and procedure not meeting requirements of this Specification Section.

e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.

f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.

g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely to result in deficient strength or durability.

2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.

3. In-place testing of concrete may be required when strength of concrete in place is considered potentially deficient.

   a. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in the structure or for selecting areas to be cored.

      1) Such tests shall not be used as a basis for acceptance or rejection.

   b. Core tests:

      1) Where required, test cores will be obtained in accordance with ASTM C42.

         a) If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60%) for seven days before test then test dry.

         b) If concrete in structure will be wet or subjected to high moisture atmosphere under service conditions, test cores after immersion in water for at least 40 hours and test wet.

         c) Testing wet or dry to be determined by Engineer.

      2) Three representative cores may be taken from each member or area of concrete in place that is considered potentially deficient.

         a) Location of cores shall be determined by Engineer so as least to impair strength of structure.

         b) If, before testing, one or more of cores shows evidence of having been damaged subsequent to or during removal from structure, damaged core shall be replaced.

      3) Concrete in area represented by a core test will be considered adequate if average strength of three cores is equal to at least 85% of specified strength and no single core is less than 75% of specified strength.

      4) Fill core holes with non-shrink grout and finish to match surrounding surface when exposed in a finished area.

4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with ACI 318, Chapter 20.

5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Engineer, at Contractor's expense.

6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

END OF SECTION

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SECTION 03 11 13
FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 05 05 - Concrete Testing and Inspection.
2. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
3. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. CT-13, Concrete Terminology.
   b. 117, Specification for Tolerances for Concrete Construction and Materials.
   c. 347R, Guide to Formwork for Concrete.

B. Qualifications:

1. Formwork, shoring and reshoring to be designed by a licensed professional engineer currently registered or having a minimum of three years of experience in this type of design work.
   a. Above qualifications apply to slabs and beams not cast on the ground.

C. Miscellaneous:

1. Design and engineering of formwork, shoring and reshoring as well as its construction is the responsibility of the Contractor.
2. Design requirements:
   a. Design formwork for loads, lateral pressures and allowable stresses outlined in ACI 347R and for design considerations, wind loads, allowable stresses and other applicable requirements of the controlling local building code.
      1) Where conflicts occur between the above two standards, the more stringent requirements shall govern.
   b. Design formwork to limit maximum deflection of form facing materials reflected in concrete surfaces exposed to view to 1/240 of span between structural members.

1.3 DEFINITIONS

A. Words and terms used in these Specifications are defined in ACI CT-13.

B. SCC: Self-Consolidating Concrete.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Manufacturer and type of proposed form ties.

B. Samples:

1. A 12 inches SQ sample of each of the following form finishes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms for Surfaces Exposed to View:

1. Wood forms:
    a. 5/8 or 3/4 inches 5-ply structural plywood of concrete form grade.
    b. Built-in-place or prefabricated type panel.
2. Metal forms:
    a. Metal forms may be used except for aluminum in contact with concrete.
    b. Forms to be tight to prevent leakage, free of rust and straight without dents to provide members of uniform thickness.

B. Forms for Surfaces Not Exposed to View:

1. Wood or metal sufficiently tight to prevent leakage.
2. Do not use aluminum forms.

2.2 ACCESSORIES

A. Form Ties:

1. Commercially fabricated for use in form construction.
    a. Field fabricated ties are unacceptable.
2. Constructed so that ends or end fasteners can be removed without causing spalling at surfaces of the concrete.
3. Embedded portion of ties to be not less than 1 inchesfrom face of concrete after ends have been removed.
4. Cone size:
    a. 3/4 inches minimum diameter cones on both ends.
    b. Depth of cone not to exceed the concrete reinforcing cover.

PART 3 - EXECUTION

3.1 PREPARATION

A. Form Surface Treatment:

1. Before placing of reinforcing steel or concrete, cover surfaces of forms with an approved release material that will effectively prevent absorption of moisture and prevent bond with concrete, will not stain concrete or prevent bonding of future finishes.
    a. A field applied form release agent or sealer of approved type or a factory applied nonabsorptive liner may be used.
2. Do not allow excess form release material to stand in puddles in forms nor in contact with hardened concrete against which fresh concrete is to be placed.

B. Apply form release material to minimize bugholes and pinholes. Follow manufacturer’s printed installation instructions specific to the form facing material.

C. Provide temporary openings at base of column and wall forms and at other points where necessary to facilitate cleaning and observation immediately before concrete is placed, and to limit height of free fall of concrete to prevent aggregate segregation.

1. Temporary openings to limit height of free fall of concrete shall be spaced no more than 8 feet apart.

D. Clean surfaces of forms, reinforcing steel and other embedded materials of any accumulated mortar or grout from previous concreting and of all other foreign material before concrete is placed.

3.2 ERECTION

A. Install products in accordance with manufacturer's instructions.

B. Tolerances:

1. Conform to ACI 117.
2. Variation from plumb:
    a. In lines and surfaces of columns, piers, walls, and in risers.
        1) Maximum in any 10 feet of height: 1/4 inches.
        2) Maximum for entire height: 1/2 inches.
    b. For exposed corner columns, control-joint grooves, and other exposed to view lines:
        1) Maximum in any 20 feet length: 1/4 inches.
        2) Maximum for entire length: 1/2 inches.
3. Variation from level or from grades specified:
    a. In slab soffits, ceilings, beam soffits and in arises, measured before removal of supporting shores.
        1) Maximum in any 10 feet of length: 1/4 inches.
        2) Maximum in any bay or in any 20 feet length: 3/8 inches.
        3) Maximum for entire length: 3/4 inches.
    b. In exposed lintels, sills, parapets, horizontal grooves, and other exposed to view lines:
        1) Maximum in any bay or in 20 feet length: 1/4 inches.
        2) Maximum for entire length: 1/2 inches.
4. Variation of linear structure lines from established position in plan and related position of columns, walls, and partitions:
    a. Maximum in any bay: 1/2 inches.
    b. Maximum in any 20 feet of length: 1/2 inches.
    c. Maximum for entire length: 1 inch.
5. Variation in sizes and location of sleeves, floor openings, and wall openings: Maximum of +1/2 inches.
6. Variation in horizontal plan location of beam, column and wall centerlines from required location: Maximum of +1/2 inches.
7. Variation in cross sectional dimensions of columns and beams and in thickness of slabs and walls: Maximum of -1/4 inches, +1/2 inches.
8. Footings and foundations:
    a. Variations in concrete dimensions in plan: -1/2 inches, +2 inches.
    b. Misplacement or eccentricity:
        1) 2% of footing width in direction of misplacement but not more than 2 inches.
    c. Thickness:
        1) Decrease in specified thickness: 5%.
        2) Increase in specified thickness: No limit except that which may interfere with other construction.
9. Variation in steps:
    a. In a flight of stairs:
        1) Rise: +1/8 inches.
        2) Tread: +1/4 inches.
    b. In consecutive steps:
        1) Rise: +1/16 inches.
        2) Tread: +1/8 inches.

10. Establish and maintain in an undisturbed condition and until final completion and acceptance of Project, sufficient control points and benchmarks to be used for reference purposes to check tolerances.
11. Regardless of tolerances listed allow no portion of structure to extend beyond legal boundary of Project.
12. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete.

C. Make forms sufficiently tight to prevent loss of mortar from concrete.

D. Place 3/4 inches chamfer strips in exposed to view corners of forms to produce 3/4 inches wide beveled edges.

E. At construction joints, overlap contact surface of form sheathing for flush surfaces exposed to view over hardened concrete in previous placement by at least 1 inch.

1. Hold forms against hardened concrete to prevent offsets or loss of mortar at construction joint and to maintain a true surface.
2. Where possible, locate juncture of built-in-place wood or metal forms at architectural lines, control joints or at construction joints.

F. Where circular walls are to be formed and forms made up of straight sections are proposed for use, provide straight lengths not exceeding 2 feet wide.

1. Brace and tie formwork to maintain correct position and shape of members.

G. Construct wood forms for wall openings to facilitate loosening, if necessary, to counteract swelling.

H. Anchor formwork to shores or other supporting surfaces or members so that movement of any part of formwork system is prevented during concrete placement.

I. Provide runways for moving equipment with struts or legs, supported directly on formwork or structural member without resting on reinforcing steel.

J. Provide positive means of adjustment (wedges or jacks) of shores and struts and take up all settlement during concrete placing operation.

1. Securely brace forms against lateral deflection.
2. Fasten wedges used for final adjustment of forms prior to concrete placement in position after final check.

3.3 REMOVAL OF FORMS

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads places thereon.

B. When required for concrete curing in hot weather, required for repair of surface defects or when finishing is required at an early age, remove forms as soon as concrete has hardened sufficiently to resist damage from removal operations or lack of support.

C. Remove top forms on sloping surfaces of concrete as soon as concrete has attained sufficient stiffness to prevent sagging.

1. Perform any needed repairs or treatment required on such sloping surfaces at once, followed by curing specified in Specification Section 03 31 31.

D. Loosen wood forms for wall openings as soon as this can be accomplished without damage to concrete.

E. Formwork for columns, walls, sides of beams, and other parts not supporting weight of concrete may be removed as soon as concrete has hardened sufficiently to resist damage from removal.

F. Where no reshoring is planned, leave forms and shoring used to support weight of concrete in place until concrete has attained its specified 28-day compressive strength.

1. Where a reshoring procedure is planned, supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.

G. When shores and other vertical supports are so arranged that non-load-carrying form facing material may be removed without loosening or disturbing shores and supports, facing material may be removed when concrete has sufficiently hardened to resist damage from removal.

3.4 RESHORING

A. No construction loads shall be supported on, nor any shoring removed from, any part of the structure under construction except when that portion of the structure in combination with remaining forming and shoring system has sufficient strength to safely support its weight and loads placed thereon.

B. While reshoring is underway, no superimposed dead or live loads shall be permitted on the new construction.

C. During reshoring do not subject concrete in structural members to combined dead and construction loads in excess of loads that structural members can adequately support.

D. Place reshores as soon as practicable after stripping operations are complete but in no case later than end of working day on which stripping occurs.

E. Tighten reshores to carry their required loads without overstressing.

F. Shoring, reshoring and supporting formwork may be removed when concrete has reached the concrete strength required by the formwork designer's structural calculations.

G. For floors supporting shores under newly placed concrete leave original supporting shores in place or reshore.

1. Reshoring system shall have a capacity sufficient to resist anticipated loads.
2. Locate reshores directly under a shore position above.

H. In multi-story buildings, extend reshoring over a sufficient number of stories to distribute weight of newly placed concrete, forms, and construction live loads in such a manner that design superimposed loads of floors supporting shores are not exceeded.

3.5 FIELD QUALITY CONTROL

A. Special Inspection:

1. See Section 01 45 33.
2. See Section 03 05 05.

END OF SECTION

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SECTION 03 15 19
ANCHORAGE TO CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for anchorages in concrete, including: cast-in-place anchor bolts, anchor rods, reinforcing anchorage adhesive, and post-installed concrete anchors required for the Project but not specified elsewhere in the Contract Documents.
2. Delegated design requirements for concrete anchors not expressly shown or indicated on the Drawings or elsewhere in the Contract Documents, including, but not limited to, anchorages in concrete for the following structural and nonstructural components:
    a. Structural members and accessories.
    b. Metal, wood, and plastic fabrications.
    c. Architectural Work, including building components, finishes, specials, facility equipment and conveying equipment, furnishings, and special construction Work.
    d. Mechanical and electrical Work, including process-mechanical Work, site and infrastructure Work, electrical Work, communications Work, electronic safety and security systems Work, and others.
    e. Fire suppression, plumbing, and HVAC Work.
    f. Other components requiring anchorages to concrete.

B. Related Requirements: Include but are not necessarily limited to:

1. Section 03 05 05 - Concrete Testing and Inspection.

1.2 REFERENCES

A. Definitions and Terminology:

1. This provision presents definitions and terminology, which have the meanings indicated in this provision, applied to the singular or plural thereof, and without regard to use of initial capital letters.
    a. Adhesive Anchors:
        1) Post-installed anchors developing their strength primarily from chemical bond between the concrete and the anchor.
        2) Includes anchors using acrylics, epoxy and other similar adhesives.
    b. Anchor Bolt: Any cast-in-place anchorage that is made of a headed (i.e. bolt) material.
    c. Anchor Rod: Any cast-in-place or post-installed anchorage made from unheaded, threaded, rod or deformed bar material.
    d. Concrete Anchor: Generic term for either an anchor bolt or an anchor rod.
    e. Galvanizing: Hot-dip galvanizing in accordance with ASTM A123, ASTM A153 or ASTM F2329 with minimum coating of 2.0 ounces of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by reference standard.
    f. Hardware: As defined in ASTM A153or ASTM F2329.
    g. MPII: Manufacturer's printed installation instructions.
    h. Mechanical Anchors:
        1) Post-installed anchors developing their strength from attachment other than thru adhesives or chemical bond to concrete.
        2) Includes expansion anchors, expansion sleeve, screw anchors, undercut anchors, specialty inserts and other similar types of anchorages.
        3) Drop-in anchors and other similar non-ICC ES approved anchors are unacceptable.

i. Post-Installed Anchor: Adhesive or mechanical anchor installed into previously placed and adequately cured concrete.

B. Reference Standards:

1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete and Commentary.
2. American Concrete Institute/Concrete Reinforcing Steel Institute (ACI-CRSI):
   a. Adhesive Anchor Installation Certification Program: Adhesive Anchor Installer.
3. American Institute of Steel Construction (AISC):
   a. 303, Code of Standard Practice for Steel Buildings and Bridges.
   b. 355.2, Seismic Testing of Post-Installed Concrete and Masonry Anchors in Cracked Concrete.
   c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.
4. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   c. A123, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   d. A153, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
   f. A496, Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
   g. A563, Standard Specification for Carbon and Alloy Steel Nuts.
   h. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   i. F436, Standard Specification for Hardened Steel Washers.
   j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   k. F594, Standard Specification for Stainless Steel Nuts.
   l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
   m. F2329, Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners
5. International Code Council Evaluation Service (ICC-ES):
   a. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   b. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Code-required Special Instructions:
   a. Special Inspection is required in accordance with the building code for all concrete anchorages.
   b. Notify the Special Inspector that an inspection is required prior to concrete placement (or during post-installed anchorage installation).
   c. See the “Field Quality Control” Article in “Part 3 – Execution” of this Section for additional requirements.

B. Qualifications:

1. Installer:

a. Installer for post-installed anchors shall be trained by the manufacturer or certified by a training program approved by the Engineer.

b. The provision, immediately below, applies when the applicable building code is based on the 2012 (or later) model International Building Code. When the optional text provision, above, is retained, delete the provision immediately below. Installer for adhesive anchors installed in horizontal, upward incline, or overhead applications shall be certified by ACI-CRSI Adhesive Anchor Installation Certification Program.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Submit schedule (table or listing) of types, sizes (diameter, length, embedment length), material, finish, and proposed manufacturers of anchorages to concrete to be provided. Apportion by Project-specific application (for example, “Anchorages for cooling water pumps in basement”) and indicate where anchorages are fully-designed by Engineer and those for which final design was prepared by delegated design professional.
   b. Engineer’s approval of such Shop Drawing will be only for anchorages fully designed by Engineer. For anchorages for which final design is by delegated design professional, include on such Shop Drawing delegated design professional’s approval stamp.
2. Product Data: Submit as Action Submittals product data for anchorages to concrete fully designed by Engineer. For anchorages to concrete for which final design is by delegated design professional, submit as Informational Submittals bearing approval stamp of delegated design professional.
   a. Manufacturer’s express, written acknowledgement that proposed items comply with referenced standards indicated in this Section and, as applicable, by delegated design professional.
   b. Manufacturer published data and information for each anchor.
      1) Clearly indicate items that are proposed for the Work. Neatly strike out or obscure materials and products not proposed.
   c. Manufacturer's published installation instructions and instructions for code-required special inspections and tests.
   d. Post-Installed Anchors: In addition, submit for each post-installed anchor system current ICC-ES report , indicating the following:
      1) Manufacturer’s certification that anchors comply with requirements indicated in the Contract Documents.
      2) Performance data indicating that anchor is approved by its manufacturer for use in cracked concrete.
      3) Seismic design categories for which anchor system is approved by ICC-ES report.
   e. Anchorage layout drawings and details:
      1) Drawings showing location, configuration, spacing and edge distance.
3. Samples:
   a. Submit representative Samples of anchorages to concrete, when requested by Engineer. Engineer’s approval of Samples will be for type and finish only.

B. Informational Submittals: Submit the following:

1. Shop Drawings and Product Data Approved by Delegated Design Professional:
   a. Submit with delegated design professional’s approval stamp those Shop Drawings and product data Submittals indicated in this Article but for which final design was performed by delegated design professional.
2. Calculations by Delegated Design Professional:
   a. Submit sealed and signed calculations for sizing and determining embedment length of anchorages to concrete not fully designed by Engineer.

b. Post-Installed Anchors Designed by Delegated Design Professional: In addition, also submit design calculations:
   1) Indicate design load to each anchor.
   2) When design load is not indicated on the Drawings, include calculations to develop anchor forces based on performance and design criteria indicated in this Section.

3. Supplier's Instructions:
   a. Submit manufacturer's published instructions for installation.
4. Field Quality Control Submittals:
   a. Submit written results of required field quality control activities indicated in this Section.
5. Reports of Supplier's Visits to Site:
   a. Submit each written report of visit to the Site by Supplier's factory trained representative and delegated design professional. For each, indicate date and time of visit, purpose of visit, observations made, decisions made, problems encountered, and other pertinent information.
6. Qualifications Statements:
   a. Delegated design professional.
   b. Each installer.

PART 2 - PRODUCTS

2.1 MATERIALS – ALL ANCHORAGES

A. Materials – General:

1. This Article applies to all anchorages to concrete, regardless of whether fully designed by Engineer or delegated design professional. Requirements for delegated designs are in the following Article.
2. Additional requirements for anchorages fully designed by Engineer are indicated in the Article following requirements for delegated design anchorages.
3. For structural applications, do not use powder actuated fasteners and other types of bolts or fasteners not specified in this Section unless approved by Engineer or otherwise required by the Contract Documents.

B. Description:

1. Provide anchorages to concrete, of the types shown or indicated, to secure to concrete materials, equipment, and appurtenances installed as part of the Work.
2. Locations where anchorages are required are generally shown or indicated on the Drawings. Where not shown or indicated on the Drawings provide anchorages or the types required for materials, equipment, and systems where such materials, equipment, and systems are shown on the Drawings.
3. Anchorages required include those for materials, equipment, and systems shown on the structural Drawings and Drawing other than the structural Drawings.
4. Design loads for concrete anchorages are shown or indicated on the Drawings for anchorages where design responsibility is delegated to Contractor's delegated design professional. For such anchorages, embedment depths are not shown or indicated.

C. Cast-in-place Concrete Anchors:

1. Buildings, non-building structures, and equipment, unless otherwise specified:
   a. ASTM F1554, Grade 36 or Grade 55 with weldability supplement S1 for galvanized threaded rods.
   b. ASTM A307, Grade A for galvanized headed bolts.
2. All other cast-in-place concrete anchors:
   a. Stainless steel with matching nut and washer.
   b. Submerged application: ASTM F593, Type 316, minimum yield strength of 45,000 psi.

c. Non-submerged application: ASTM F593, Type 304 or Type 316, minimum yield strength of 45,000 psi.

D. Post-Installed Mechanical and Adhesive Concrete Anchors:

1. Submerged application: ASTM F593, Type 316, minimum yield strength of 45,000 psi with matching nut and washer.
2. Non-submerged application: ASTM F593, Type 304 or Type 316, minimum yield strength of 45,000 psi with matching nut and washer.
3. Post-installed anchors and related materials shall be listed by ICC-ES or Engineer-approved equivalent.

E. Reinforcing: Comply with Section 03 21 00 - Reinforcement.

F. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

G. Deformed Bar Anchors: ASTM A496 with minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

H. Washers:

1. ASTM F436 unless indicated otherwise, finish to match bolt.
2. When stainless steel anchorage is provided for cast-in-place anchorages, provide washers of the same material and alloy as in the associated anchorage.
3. Plate washers: Minimum 1/2inch thick fabricated ASTM A36 square plates as required.
4. Comply with manufacturer’s written instructions for all post-installed anchorages.

I. Nuts:

1. ASTM A563 for cast-in-place anchorages.
2. When stainless steel anchorages are provided for cast-in-place anchorages, nuts shall comply with ASTM F594 and shall match material and alloy of the associated anchorage.
3. Follow manufacturer’s requirements if using post-installed anchorage.

J. Galvanizing Repair Paint:

1. High zinc dust content paint for regalvanizing welds and abrasions.
2. ASTM A780.
3. Zinc content: Minimum 92 percent in dry film.
4. Products and Manufacturers: "ZRC Cold Galvanizing", by ZRC; or "High Performance Zinc Spray", by Clearco; or equal.

2.2 DELEGATED DESIGN ANCHORAGES TO CONCRETE

A. Manufacturers:

1. Post-installed anchor systems for indicated manufacturers are acceptable only when a current ICC-ES evaluation report is furnished as a Submittal and the subject anchorage system is approved by delegated design professional.
   a. Hilti.
   b. Dewalt.
   c. Simpson Strong-Tie.
   d. Or equal.

B. Description: Perform delegated design for anchorages when one or more of the following applies:

1. Design load for concrete anchorage is shown or indicated on the Drawings and anchorage embedment depth is not shown or indicated.
2. When specifically required by the Contract Documents.

3. When an anchorage is necessary but is not shown or indicated on the Drawings.
4. Anchorages shown on the Drawings other than the structural Drawings.

C. Performance and Design Criteria for Delegated Design Anchorages:

1. Determine design loads, including wind and seismic loads, in accordance with applicable building code and other Laws and Regulations.
2. For anchorage of equipment and non-structural components, use actual dead load and operating loads obtained by Contractor or delegated design professional from manufacturer. Design loads shall include operating conditions when equipment or element of the Work is in operation, dynamic loads, and other loads as appropriate or required by the building code or other Laws or Regulations.
3. Design assuming cracked concrete.

2.3 ANCHORAGES FULLY DESIGNED BY ENGINEER

A. When size, length, and details of anchorage are shown or indicated on the structural Drawings, such anchorages are considered as fully designed by Engineer and delegated design of such anchorage is not required.

B. Manufacturers:

1. For post-installed anchor systems regardless of whether proposed manufacturer is indicated below, furnish as Submittal current evaluation agency report and anchor system is certified by ICC-ES for cracked concrete conditions.
2. Mechanical Anchors:
   a. Hilti:
      1) Kwik Bolt TZ (ICC-ES ESR-1917).
   b. Dewalt:
      1) Power-Stud+ SD1 (ICC-ES ESR-2818).
   c. Simpson Strong-Tie:
      1) Strong-Bolt 2 (ICC-ES ESR-3037).
   d. Or equal.
3. Adhesive Anchors for Concrete:
   a. Hilti:
      1) HIT RE 500 V3 (ICC ESR-3814).
   b. Dewalt:
      1) PURE110+ (ICC-ES ESR-3298).
   c. Simpson Strong-Tie:
      1) SET-3G (ICC ES 4057)
   d. Or equal.
4. Screw Anchors for Concrete:
   a. Hilti:
      1) Kwik HUS-EZ Screw (ICC-ES ESR-3027).
   b. Dewalt:
      1) Screw-Bolt+ (ICC-ES ESR-3889).
   c. Simpson Strong-Tie:
      1) Titen HD (ICC-ES ESR-2713).
   d. Or equal.
5. Requests, if any, for Engineer's approval of "or-equals" or substitutes shall indicate proposed anchor has at least the same tension and shear strength as the associated anchorage products indicated by name in this Article.

PART 3 - EXECUTION

3.1 PREPARATION

A. For cast-in-place concrete anchorages, allow adequate time for proper installation, inspection, and observation prior to placing concrete.

B. Prior to installation, inspect and verify areas and conditions under which concrete anchorages will be installed.

1. Notify Engineer of conditions detrimental to proper and timely completion of the Work.
2. Do not proceed with the Work until unsatisfactory conditions are properly remedied.

3.2 INSTALLATION

A. Installation Requirements - General:

1. Install items in accordance with the Contract Documents, manufacturer's written instructions, and Laws and Regulations. Where such requirements conflict, obtain interpretation or clarification from Engineerprior to commencing the associated Work.
2. Perform the following unless shown or indicated otherwise:
   a. Provide washers for all anchorages.
   b. Where exposed, extend threaded anchorage a minimum of 0.5 inch above top of fully-engaged nut. If anchorage is cut off to required maximum height, dress the threads to allow nuts to be removed without damage to nuts.
3. Tightening of nuts: Do the following after nuts are snug-tightened down:
   a. Upset anchorage threads to prevent nuts from backing off. Provide double nut or lock nut in lieu of upset threads for items that may require future removal.
   b. For cast-in-place anchorages (excluding post-installed anchorages), tighten nuts an additional 1/8 turn beyond snug tight to prevent nuts from backing off.
   c. When two nuts are used per concrete anchor above the base plate, tighten top nut an additional 1/8 turn to "lock" the two nuts together.
   d. For post-installed anchorages, comply with MPII.
4. Secure architectural components to avoid aesthetic distortion and to avoid overstressing fasteners from expansion, contraction, or installation.

B. Cast-in-Place Anchorages:

1. Provide where anchor rods or anchor bolts are indicated on the Drawings, unless another anchor type is approved by Engineer.
2. Provide concrete anchorages as shown on the Drawings or as required to secure the Work to concrete.
3. Tie cast-in-place anchorage in position to embedded reinforcing steel using wire.
4. Tack welding of anchorage is prohibited.
5. Chase threads as required and coat projected portion of carbon steel anchors and nut threads with a heavy coat of clean grease after concrete has cured.
6. Anchorage location Tolerance: in accordance with AISC 303.
7. Provide steel or durable wood templates for all column and equipment anchorages. Place templates above top of concrete; do not impede proper concrete placement and consolidation.

C. Mechanical Anchorages:

1. Use only where specifically indicated on the Drawings or when approved for use by the Engineer.
2. Do not use where subjected to vibration.
3. May be used in overhead applications.

4. Contact Engineer for clarification when anchors will not be installed in compliance with manufacturer's printed installation requirements.

D. Post-installed Anchorages:

1. For post-installed anchors, comply with MPII regarding hole diameter and depth required to fully develop the tensile strength of anchor or reinforcing bar.
2. Use hammer drills to create holes.
3. Properly clean out holes in accordance with the associated ICC-ES report using non-metallic, fiber bristle brush and compressed air, or as otherwise necessary to remove all loose material from each hole prior to installing anchor in the presence of Special Inspector.
4. Adhesive Anchorages:
   a. Provide only where specifically indicated on the Drawings or when approved for use by Engineer.
   b. May be provided where subjected to vibration or at buried or submerged locations.
   c. Do not install for overhead applications or sustained tension loading conditions such as utility hangers.
   d. Install adhesive anchors in concrete aged not less than 21 days.

E. Finishes:

1. Repair of damaged galvanized surfaces:
   a. Prepare damaged surfaces by abrasive blasting or power sanding.
   b. Repair damaged galvanized surfaces in accordance with ASTM A780.
   c. Apply galvanizing repair paint to not less than 6 mils dry film thickness in accordance with galvanizing repair material manufacturer's instructions and ASTM A780.

F. Ensure that embedded items are protected from damage and are not filled in with concrete or related materials.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

1. Special Inspections: Comply with Section 01 45 33 - Code-Required Special Inspections and Procedures.
2. Comply with Section 03 05 05 - Concrete Testing and Inspection.
3. Tests and inspections of anchorages shall comply with ACI 355.2 and/or ACI 355.4 as applicable.
4. Owner reserves the right to inspect and test completed anchorages at a minimum of 10 to 25 percent of provided anchorages.

B. Supplier’s services:

1. Post-installed anchor manufacturer’s representative shall demonstrate and observe the proper installation procedures for the post-installed anchors.

C. Defective Work:

1. Anchorages that do not successfully pass required field tests and inspections or that are otherwise deemed defective by Engineer shall be remedied, in accordance with the Contract Documents, at no cost to Owner.

3.4 CLEANING

A. After concrete has been placed, remove protection and clean all anchorage of all concrete, dirt, and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings when specified in Specification Section 09 91 10.

END OF SECTION

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SECTION 03 21 00
REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bar requirements for concrete construction.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 05 05 - Concrete Testing and Inspection.
2. Section 03 15 19 - Anchorage to Concrete.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. SP 66, ACI Detailing Manual.
   b. 117, Specification for Tolerances for Concrete Construction and Materials.
   c. 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
   d. 318, Building Code Requirements for Structural Concrete.
2. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A276, Standard Specification for Stainless Steel Bars and Shapes.
   c. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   d. A706, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
   e. A970, Standard Specification for Headed Steel Bars for Concrete Reinforcement.
   f. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
3. Concrete Reinforcing Steel Institute (CRSI):
   a. Manual of Standard Practice.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Mill certificates for all reinforcing.
   d. Manufacturer and type of proprietary reinforcing mechanical splices.
2. Qualifications of welding operators, welding processes and procedures.
3. Reinforcing number, sizes, spacing, dimensions, configurations, locations, mark numbers, lap splice lengths and locations, concrete cover and reinforcing supports.
4. Sufficient reinforcing details to permit installation of reinforcing.
5. Reinforcing details in accordance with ACI SP 66 and ACI 315.
6. Locations where proprietary reinforcing mechanical splices are required or proposed for use.

7. Shop Drawings shall be in sufficient detail to permit installation of reinforcing without reference to Contract Drawings.
    a. Shop Drawings shall not be prepared by reproducing the plans and details indicated on the Contract Drawings but shall consist of completely redrawn plans and details as necessary to indicate complete fabrication and installation of all reinforcing steel.
    b. Where multiple types of supports for reinforcing steel (such as chairs, runners, bolsters, and other types of supports) will be used in the Work, clearly indicate on the Shop Drawings the support types and materials of supports.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Support and store all reinforcing above ground.

B. Ship to jobsite with attached plastic or metal tags with permanent mark numbers which match the Shop Drawing mark numbers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Reinforcing adhesive anchors:
    a. See Specification Section 03 15 19.
2. Reinforcing mechanical splices:
    a. Lenton Rebar Splicing by Erico, Inc.
    b. Richmond dowel bar splicer system by Richmond Screw and Anchor Co., Inc.
    c. Bar-Grip Systems by Barsplice Products, Inc.

2.2 MATERIALS

A. Reinforcing Bars: ASTM A615, grade 60, deformed.

B. Reinforcing Bars to be Welded: ASTM A706, Grade 60, deformed.

C. Smooth Dowel Bars:

1. All other locations: ASTM A36, with metal end cap to allow longitudinal movement equal to joint width plus 1 inch.

D. Reinforcing Adhesive Anchors:

1. See Specification 03 15 19.

2.3 ACCESSORIES

A. Chairs, Runners, Bolsters, Spacers, Hangers, and Other Reinforcing Supports:

1. Metal fabrications with plastic-coated tips in contact with forms.
    a. Plastic coating meeting requirements of CRSI Manual of Standard Practice.
2. All plastic construction meeting the requirements of CRSI Manual of Standard Practice.
    a. 100% non-metallic, non-corrosive.
    b. Required for all walls and elevated construction exposed to liquid containing structures.

2.4 FABRICATION

A. Tolerances:

1. Conforms to ACI 117, expect as modified herein.
2. Sheared lengths: +1 inches.
3. Overall dimensions of stirrups, ties and spirals: +1/2 inches.
4. All other bends: +0 inches, -1/2 inches.

B. Minimum diameter of bends measured on the inside of the reinforcing bar to be as indicated in ACI 318 Paragraph 7.2.

C. Ship reinforcing to jobsite with attached plastic or metal tags.

1. Place on each tag the mark number of the reinforcing corresponding to the mark number indicated on the Shop Drawing.
2. Mark numbers on tags to be so placed that the numbers cannot be removed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Tolerances:

1. Conform to ACI 117, except as modified herein.
2. Reinforcing placement:
   a. Clear distance to formed surfaces: +1/4 inches.
   b. Minimum spacing between bars: -1/4 inches.
   c. Top bars in slabs and beams:
      1) Members 8 inches deep or less: +1/4 inches.
      2) Members between 8 inches and 2 feet deep: -1/4 inches, +1/2 inches.
      3) Members more than 2 feet deep: -1/4 inches, +1 inches.
   d. Crosswise of members: Spaced evenly within +1 inches.
   e. Lengthwise of members: +2 inches.
3. Minimum clear distances between reinforcing bars:
   a. Beams, walls and slabs: Distance equal to bar diameter or 1 inch, whichever is greater.
   b. Columns: Distance equal to 1-1/2 times the bar diameter or 1-1/2 inches, whichever is greater.
   c. Beam and slab reinforcing shall be threaded through the column vertical rebars without displacing the column vertical bars and still maintaining the clear distances required for the beam and slab reinforcing bars.

B. Minimum concrete protective covering for reinforcement: As shown on Drawings.

C. Unless indicated otherwise on Drawings, provide splice lengths for reinforcing as follows:

1. For reinforcing: Class B splice meeting the requirements of ACI 318.
2. Provide splices of reinforcing not specifically indicated or specified subject to approval of Engineer.
   a. Mechanical proprietary splice connectors may only be used when approved or indicated on the Contract Drawings.

D. Welding:

1. Welding reinforcing is not permitted.

E. Placing Reinforcing:

1. Assure that reinforcement at time concrete is placed is free of mud, oil or other materials that may affect or reduce bond.
2. Reinforcement with rust, mill scale or a combination of both will be accepted as being satisfactory without cleaning or brushing provided dimensions and weights including heights of deformations on a cleaned sample is not less than required by applicable ASTM specification that governs for the reinforcing supplied.
3. Reinforcing support:
   a. Uncoated reinforcing:

1) Support reinforcing and fasten together to prevent displacement by construction operations.
    a) Locate and support reinforcement with bar supports to maintain minimum concrete cover.
    b) Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
    c) Reinforcement shown on the Contract Documents may not be repositioned for use a support for reinforcement. Additional drop bars may be provided for support of reinforcing,
2) Reinforcing supported on ground:
    a) Slab on grade and other members with only one mat of reinforcing:
        (1) Provide metal bar supports with bottom plate.
        (2) Do not use concrete blocks to support slab-on-grade reinforcing.
    b) All other members: Provide supporting concrete blocks or metal bar supports with bottom plate.
3) Reinforcing supported on formwork:
    a) Concrete surfaces in contact with or over process liquid: All-Plastic chairs, runners and bar supports.
    b) All other formed surfaces:
        (1) Provide plastic-coated metal chairs, runners, bolsters, spacers, hangers and other reinforcing support.
        (2) Only tips in contact with the forms need to be plastic coated.

4. Where parallel horizontal reinforcement in beams is indicated to be placed in two or more layers, bars in the upper layers shall be placed directly above bars in the bottom layer with clear distance between layers to be 1 inch.
    a. Place spacer bars at 3 feet maximum centers to maintain the required 1 inch clear distance between layers.
5. Extend reinforcement to within 2 inches of concrete perimeter edges.
    a. If perimeter edge is formed by earth, extend reinforcement to within 3 inches of the edge.
6. To assure proper placement, furnish templates for all column vertical bars and dowels.
7. Do not bend reinforcement after embedding in hardened concrete unless approved by Engineer.
    a. Do not bend reinforcing by means of heat.
8. Do not tack weld reinforcing.
9. Embed reinforcing into hardened concrete utilizing adhesive anchor system specifically manufactured for such installation:
    a. See Specification Section 03 15 19.

3.2 FIELD QUALITY CONTROL

A. Reinforcement Congestion and Interferences:

1. Notify Engineer whenever the specified clearances between bars cannot be met.
2. Do not place any concrete until the Engineer submits a solution to reinforcing congestion problem.
3. Reinforcing may be moved as necessary to avoid interference with other reinforcing steel, conduits, or embedded items.
4. If bars are moved more than one bar diameter, obtain Engineer's approval of resulting arrangement of reinforcing.
5. No cutting of reinforcing shall be done without written approval of Engineer.

B. Special Inspection:

1. See Section 01 45 33.
2. See Section 03 05 05.

END OF SECTION

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SECTION 03 31 30
CONCRETE MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for concrete materials, including:
   a. Materials, including various types of grout, admixtures, cement, sand, aggregate, and other materials.
   b. Concrete strength and proportioning, including design mixes for:
      1) Normal weight concrete.
      2) Grout.

B. Scope:

1. Unless shown or indicated otherwise in the Contract Documents, concrete Work shall comply with:
   a. ACI 301.
   b. Laws and Regulations, including applicable building code.
2. In this Section, material is apportioned into the following grouting types:
   a. Base plates for columns and equipment.
   b. As otherwise shown or indicated in the Contract Documents.
3. This Section addresses materials for concrete. Other Specifications sections present other requirements for complete concrete Work, including, but not necessarily limited to:
   a. Section 03 05 05 - Concrete Testing and Inspection.
   b. Section 03 11 13 - Formwork.
   c. Section 03 21 00 - Reinforcement.
   d. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
   e. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
   f. Others as indicated in the Contract Documents.

C. Related Requirements: Include but are not necessarily limited to:

1. Section 03 05 05 - Concrete Testing and Inspection.
2. Section 03 15 19 - Anchorage to Concrete.
3. Section 03 21 00 - Reinforcement.
4. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.

1.2 REFERENCES

A. Abbreviations and Terminology:

1. Abbreviations: The following abbreviations are used in this Section:
   a. “AAR” means deleterious “alkali-aggregate reaction”, resulting from either alkali-silica reactive (ASR) or alkali-carbonate reactive (ACR) aggregates.
   b. “SCM” means “supplementary cementitious materials”, with the meaning indicated below.
   c. “CLSM” means controlled low strength material in accordance with requirements of this Section.
2. Terminology: Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this Section have the meanings indicated below:
   a. “Supplementary cementitious materials” (SCM) means fly ash, silica fume, and GGBFS.

b. Independent Laboratory:

1) Testing shall be performed by an independent laboratory complying with requirements of the generally recognized accrediting entity for the jurisdiction where the Site is located.

2) Testing laboratory shall obtain all concrete samples and waterproofing product samples from the manufacturer of the associated product or material.

B. Reference Standards:

1. American Concrete Institute (ACI):
   a. CT-13, Concrete Terminology.
   b. 117, Specification for Tolerances for Concrete Construction and Materials.
   c. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
   d. 212.3R, Chemical Admixtures for Concrete.
   e. 232.2R, Use of Fly Ash in Concrete.
   f. 301, Specifications for Structural Concrete for Buildings.
2. ASTM International (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
   c. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   d. C125, Terminology Relating to Concrete and Concrete Aggregates.
   e. C150, Standard Specification for Portland Cement.
   f. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
   g. C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
   h. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
   i. C494, Standard Specification for Chemical Admixtures for Concrete.
   j. C595, Standard Specification for Blended Hydraulic Cements.
   k. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   l. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
   m. C1116, Standard Specification for Fiber-Reinforced Concrete.
   n. C1399, Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
   o. C1609, Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading).
   p. C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
   q. C1778, Standard Guide for Reducing Risk of Deleterious Alkali-Aggregate Reaction in Concrete.
3. Steel Deck Institute (SDI):
   a. Design Manual for Composite Decks, Form Decks and Roof Decks.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:

a. Schedule (table) of concrete materials proposed, listed by each specified grouping of concrete Work, including, but not limited to, aggregates, sand, cement (by type), SCM, admixtures, synthetic fibers, grouts, and other materials. For each separate material and product, indicate manufacturer and type of material.

b. Mix Designs:

1) Proposed mix design for each concrete grouping required. For each, indicate concrete designation (type) indicated in the Contract Documents, proposed materials and proportioning, and intended special uses, such as concrete intended for placement in cold weather or warm weather, concrete to be placed by pumping, concrete intended for specific locations in the Work, and others.

2) Engineer's approval of mix design Shop Drawing is only for limited purposes indicated in the Contract Documents, including the General Conditions, and in no way reduces or mitigates Contractor's responsibility for construction means, methods, techniques, procedures, and sequences.

2. Product Data:

a. Written affidavit stating materials proposed comply with requirements of reference standards indicated in this Section and, where applicable, compliance with standard specifications for highway and bridge construction in the jurisdiction of the Site. Clearly indicate specific reference standards applicable to each specific material.

b. For aggregate and sand, indicate source (quarry) and gradation of materials proposed for use. Indicate the specific concrete mix design(s) proposed for each.

c. For cement and SCM, indicate material source and submit manufacturer's technical data (except safety data sheets).

d. For each proposed admixture and type of grout material (including non-shrink grouts, epoxy grout, and grout cure/seal compound), submit manufacturer's published technical data (except safety data sheets).

B. Informational Submittals: Submit the following:

1. Certifications: Submit concurrent with, but separate from, associated Shop Drawings and product data Submittals:

a. Certification of standard deviation, in units of pounds per square inch, for ready mix plant furnishing concrete.

b. SCM: Certification that SCM complies with quality requirements of this Section, and SCM Supplier's certified test reports of SCM delivered to concrete Supplier.

c. ASTM C33: Certification that class of coarse aggregate complies with ASTM C33 for type and location of concrete Work.

d. Aggregate:

1) Certification of aggregate gradation.

2) Certification of coarse aggregate impurities relative to alkali-aggregate reactivity in accordance with ASTM C1778.

e. Certification of shrinkage test results.

2. Test Reports:

a. Cement and SCM mill certificates for all materials to be supplied.

b. Test results for AAR impurities of coarse aggregates within proposed mixes, in accordance with ASTM standards cited in this Section.

3. Supplier's Instructions: Submit concurrent with, but separate from, associated product data Submittals:

a. Manufacturer's written instructions on proper storage, handling, mixing, and use of materials furnished.

1.4 DELIVERY, STORAGE AND HANDLING

A. Storage of Materials:

1. Admixtures:
    a. Store admixtures in manner that avoids contamination, evaporation, and damage.
    b. For admixtures used in form of suspensions or non-stable solutions, perform agitating as recommended by manufacturer to ensure uniform distribution of ingredients.
    c. Protect liquid admixtures from freezing and temperature changes that adversely affect admixture characteristics and performance.
2. Cement and SCM:
    a. Store cement and SCM in containers in weathertight space that prevent contamination with moisture and other contaminants.
3. Aggregates:
    a. Store and access aggregates in manner avoiding excessive segregation and preventing contamination with other materials and other sizes of like aggregate.
    b. Do not use frozen or partially frozen aggregate.
4. Sand: Allow natural sand to drain until sand has relatively uniform moisture content, prior to use.
5. If stockpiled materials contact the ground, unless such materials are stored on a clean, firm, reasonably impervious surface such as concrete or asphalt paving, do not use in the concrete Work bottom six inches of stockpiled materials.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:
1. Provide ASTM C150, Type IL cement, unless otherwise required by the Contract Documents.
2. Cement type provided shall match cement type used in associated approved mix design.

B. SCM:
1. Fly Ash:
    a. ASTM C618, Class F or Class C.
    b. Non-staining.
    c. Appropriate for providing hardened concrete of uniform, light-gray color.
    d. Compatible with all other concrete ingredients. Fly ash shall have no deleterious effect on hardened concrete Work.
    e. Produced by source approved, by state department of transportation in the same jurisdiction as the Site, for use in concrete for highway bridges.
    f. Evaluate and use in accordance with ACI 232.2R.
2. SCM type used shall match SCM type used in associated approved mix design.

C. Admixtures:
1. Admixtures – General:
    a. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in mix design approved by Engineer.
    b. Provide admixtures certified by manufacturers as compatible with other admixtures proposed.
2. Air Entraining Admixtures: Comply with ASTM C260.
3. Water Reducing Admixtures:
    a. Provide water-reducing admixtures in all concrete mixes to provide and maintain required water-to-cement ratio without additional cement.
    b. Water Reducing, Retarding and Accelerating: Comply with ASTM C494 Types A through E, and ACI 212.3R.

c. High Range Water Reducers (Superplasticizers):
1) Required for pumped concrete.
2) Comply with ASTM C494 Types F and G.

4. Hydration Stabilizer:
a. Comply with ASTM C494 Type D.

5. Admixture Chlorides – General:
a. Provide chloride-free admixtures.
b. Do not use calcium chloride.

D. Water:

1. Potable in accordance with Laws and Regulations.
2. Clean and free from deleterious substances.
3. Free of oils, acids, and organic matter. Comply with ASTM C1602.

E. Aggregates for Normal Weight Concrete:

1. Comply with ASTM C33.
2. Fine aggregates and coarse aggregates are separate ingredients.
3. Provide aggregates acceptable for bridge construction in accordance with the third-party standard specifications indicated below in this provision.
4. Blended aggregates are acceptable when a combined sieve analysis is performed and indicates compliance with ASTM C33. Submit results of such sieve analysis and obtain Engineer's approval before using such aggregate in the Work.
5. Coarse Aggregate:
a. Material shall be well-graded, washed aggregate, free of organic material.
b. Gradation: In accordance with Table 03 31 30-A in this section's "Mixes" Article.
6. Alkali-Reactive Aggregates:
a. Aggregates that may be deleteriously reactive, when combined with alkalis in cement, are unacceptable.
b. Evaluate proposed aggregates for potential deleterious alkali-aggregate reaction in concrete in accordance with ASTM C1778.
1) Submit to Engineer results of source quality control testing for alkali-aggregate reactivity presenting the following:
a) Analysis and classification of aggregates in accordance with ASTM C1778
b) Results of source quality control analysis of aggregates.
c) Include the flow from Figure 1 of ASTM C 1778 indicating test results sequence.
d) Field performance history alone shall not be submitted to document acceptable aggregate performance.
e) Size and exposure condition of the Work in Table 2 of ASTM C 1778.
f) Structure class for use in Table 3 of ASTM C1778: Class SC3SC4.

F. Maximum total water-soluble chloride ion content for concrete mix including all ingredients measured as weight percent of cement in accordance with ASTM C1218:

1. All other concrete: 0.10.

G. Sand Cement Grout (termed "Grout" on the Drawings):

1. Description: Typical use is for filling keyways in precast construction, and as otherwise required by the Contract Documents.
2. Performance Criteria:
a. Minimum 28 day compressive strength:

b. 3,000 PSI.
c. Strength shall be not less than strength of adjacent concrete to which grout is applied.

3. Materials:
   a. Provide sand cement grout as approximately three parts sand to one part Portland cement, 4.5 percent to 7.5 percent entrained air and water to provide slump allowing grout to completely fill required spaces and surround adjacent reinforcing.
   b. Provide sand in accordance with requirements for fine aggregate for concrete.

H. Non-shrink Grout:

1. Manufacturers and Products: Subject to compliance with the contract Documents, the following are acceptable:
   a. Master Builders Solutions, Masterflow, 713.
   b. Euclid Chemical Company, NS Grout.
   c. Sika, Sika Grout 212.
   d. Or equal.
2. Description:
   a. This provision requires non-shrink, non-metallic grout. Unless otherwise shown or indicated in the Contract Documents, references to “non-shrink grout” refer to non-shrink, non-metallic grout required by this provision.
3. Performance Criteria:
   a. Non-shrink grout shall produce a positive but controlled expansion.
   b. Mass expansion shall not be created by gas liberation or by other means.
   c. Minimum 28-day Compressive Strength: 7,000 PSI.
4. Material:
   a. Provide material that is non-shrink, non-metallic, non-corrosive, and non-staining.
   b. Comply with ASTM C1107, Grade B.
   c. Premixed with water only. Add water in accordance with manufacturer’s written instructions.

I. Epoxy Grout:

1. Manufacturers and Products: Subject to compliance with the Contract Documents, the following are acceptable:
   a. Master Builders Solutions, Masterflow 648.
   b. Five Star Products, DP Five Start Epoxy Grout.
   c. Euclid Chemical Company, E3 Flowable.
   d. Sika, Sikadur 42, Grout Pak.
   e. Or equal.
   f. One manufacturer shall furnish both aggregate and adhesive.
2. Description:
   a. Three-component epoxy resin system, comprised of two liquid epoxy components and one inert aggregate filler component.
   b. Indication of locations where epoxy grout is required are indicated in the grout schedule in Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
   c. Furnish each component in separate package for mixing at the Site.
3. Performance Criteria:
   a. Minimum 28-day Compressive Strength: 13,000 psi.
4. Materials:
   a. Aggregate shall be compatible with adhesive.

2.2 MIXES

A. Mixes - General:

1. Provide concrete capable of: (a) being placed without segregation of aggregate from other components, and (b) developing all properties necessary and required.
2. Provide ready-mix concrete in accordance with ASTM C94/C94M.
3. Batching and other tolerances shall be in accordance with ACI 117.
4. All concrete shall be normal weight concrete, unless otherwise required by the Contract Documents. Normal weight concrete shall weigh approximately 145 to 150 pounds per cubic foot (without reinforcing steel), measured 28 days after placing.

B. Concrete Mixes:

1. Mix design requirements are indicated in this Section's Table 03 31 30-A, below.

C. Air Entrainment:

1. Provide air entrainment in concrete providing total air content, expressed as percent by volume, in accordance with this Section's Table 03 31 30-A, below.
2. Adjust dosage rate as necessary to compensate for shrinkage reducing admixtures and concrete placing method.

D. Slump:

1. Slump – General:
   a. Measure slump at point of discharge of wet concrete into final location.
   b. Compensate for slump loss due to placing method.
   c. Concrete with slump less than minimum required may be used provided such concrete can be properly placed and consolidated.
   d. Slump of Concrete to be Placed by Pumping:
      1) Provide water or water-reducing admixture at ready-mix plant for concrete to be placed by pumping, to allow for slump loss due to pumping.
      2) Provide additional water sufficient only so that slump of concrete at discharge end of pump hose does not exceed: (a) maximum allowable slump indicated, and (b) maximum specified water-to-cement ratio.
   e. Slump Adjustment at the Site:
      1) Slump may be adjusted at the Site by providing water reducers.
      2) Dosing shall be performed by experienced quality control technician employed by concrete Supplier. Concrete mixing thereafter shall be directed by the same technician.
   f. Slump tolerances shall comply with ACI 117.
2. Concrete for Walls and Columns:
   a. 8 inches maximum; 4 inches minimum.
   b. Slump shall be obtained by use of mid-range or high-range water reducer complying with ASTM C494.
3. All Other Members:
   a. Concrete using water reducer in accordance with ASTM C494: 8 inches maximum; 4 inches minimum.
   b. Concrete without water reducer in accordance with ASTM C494: 5 inches maximum, one inch minimum.

E. Proportioning:

1. Proportioning - General:
   a. Proportion components of concrete to provide mixture that can be placed: (a) into corners and angles of forms, and around reinforcing, by placing and consolidation

methods employed, (b) without component materials becoming segregated, and (c) without excessive, free water to collecting on concrete surface or other surfaces.

b. Proportion component elements of concrete to provide proper concrete Work, including concrete durability, strength, and other necessary and required properties.

2. Normal Weight Concrete:
   a. Normal weight concrete target cementitious materials contents and maximum water to-cementitious ratios shall be in accordance with this Section's Table 03 31 30-A, below.
   b. Target cementitious materials contents indicated in the Contract Documents are intended to provide crack-free, durable, finished concrete Work, rather than concrete Work of excessive strength.
3. SCM:
   a. SCM – General:
      1) Based on results of AAR testing by Supplier (performed in accordance with ASTM C1778) and alkali content of cement, SCM content (in accordance with this Section) may be adjusted in lieu of the indicated percentages to reduce risk associated with AAR.
      2) Use only one type of SCM in a given mix unless expressly required or approved by Engineer.
      3) Water-to-cementitious (i.e, total of SCM plus cement) ratio shall not exceed required maximum water-to-cement ratio indicated in this Section.
   b. Fly Ash:
      1) For cast-in-place concrete only, maximum of 25 percent by weight of Portland cement content, per cubic yard, may be fly ash, at rate of one pound fly ash for one pound cement.
4. Water-Reducing, Water-Retarding, and Water-Accelerating Admixtures:
   a. Provide in accordance with admixture manufacturer's written instructions.
   b. Add to mix at ready-mix plant.
   c. Use hydration stabilizer admixture, or AAR-inhibiting admixture, in concrete, as necessary and required, for placing and workability.
      1) Water reducers are required to maintain required maximum water-to-cement ratios.
5. High Range Water Reducers (Superplasticizers):
   a. Superplasticizers are required in:
      1) Concrete to be pumped, except slabs-on-grade and mats.
      2) Concrete for water-bearing structures.
      3) Other concrete Work at Contractor's option.
   b. Maximum concrete slump, before addition of admixture, shall be three inches. Maximum slump after addition of superplasticizer admixture shall be eight inches.
   c. Comply with Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing, relative to superplasticizers.
6. Normal Weight Concrete Mix Proportioning:
   a. Method 1:
      1) Use Method 1 when combination of concrete component materials and mixes will be evaluated and selected via trial-and-error.
      2) Provide mixes with suitable proportions and properties in accordance with ACI 211.1, using not less than three different water-to-cementitious ratios providing a range of concrete compressive strengths, including required average compressive strength.
      3) Trial mixes shall have slump within 0.75 inches of maximum allowed in the Contract Documents. For air-entrained concrete, air content of trial batches shall be within 0.5 percent of air entrainment required by the Contract Documents.

4) For each water-to-cementitious ratio:
    a) Provide not less than three trial compressive strength tests for concrete test age required, and cure in accordance with ASTM C192.
    b) Cylinder Size: In accordance with ASTM C31.
    c) Test for compressive strength at 28 days, in accordance with ASTM C39.
        (1) Quantity of cylinders shall comply with one of the following trial strength test:
            (a) 6-inch diameter cylinders: Two.
            (b) 4-inch diameter cylinders: Three.
5) From results of such required tests, plot curve showing relationship between water-to-cementitious ratio and compressive strength.
6) Based on required curve, select water-to-cementitious ratio for the Work, that will provide concrete of required average compressive strength.
7) Provide cementitious content and mixture proportions so maximum water cement ratio is not exceeded when slump is equal to maximum allowed in the Contract Documents.
8) Required average compressive strength is indicated below in this Section.

b. Method 2:
1) In lieu of trial mixes required by Method 1, field test results from prior projects, for concrete made using identical or substantively identical concrete component materials and proportioning, may be used by concrete supplier in determining proposed mix proportions, provided the test results are within a year of project start date.
2) Use of proposed concrete mix proportions based on field test results from prior projects are subject to approval by Engineer. Engineer's decision will be based on information in such Submittals and demonstrated ability, of such concrete successfully provided on such prior projects, to provide required average compressive strength.
3) Requirements for Submittals of Concrete Test Results from Prior Projects:
    a) Submittals of field test results from prior projects shall clearly indicate all materials, proportions, and conditions, and clearly indicate where such matters are similar to those required for the concrete Work on the Project.
    b) Changes in the materials, proportions, and conditions within submitted test results from prior projects shall have been not more restricted than those for the subject, proposed concrete mix.
    c) Field test reports from prior projects shall be in accordance with ACI 318, Paragraph 5.3.
4) Concrete proportions for the concrete Work may be determined from test results of prior projects via interpolation (by Contractor and concrete Supplier) between compressive strengths and proportions of two or more test results from prior projects, each in accordance with requirements of the Contract Documents for this Project.

7. Required average compressive strength shall exceed required 28-day compressive strength by the extent determined in accordance with ACI 318, Chapter 5 using the standard deviation of concrete ready-mix plant proposed for the Work as described in ACI 318, Chapter 5.

F. Allowable Shrinkage:

1. Provide in accordance with Table 03 31 30-A of this Section, tested in accordance with ASTM C157 at 28 days.
2. Continue testing for 64 weeks in accordance with ASTM C157 and submit results to Engineer as Informational Submittals.

3. Perform for concrete Work for all structures unless expressly indicated otherwise in the Contract Documents.

TABLE 03 31 30-A							
Type of Concrete	28-day Compressive Strength	Max. W/C Ratio	Target Total Cement (pounds)	SCM	ASTM C33 Size No.	Air Content (%)	Allowable Shrinkage Limit
Normal weight all concrete	4000 PSI	0.45	564	Note 1	57 67	4.5 to 7.5	0.048 percent

Table 03 31 30-A Notes:

1. If fly ash is proposed for use, the weight of fly ash plus weight of Portland cement shall be used to comply with total target cement content.
2. Unless otherwise indicated, larger aggregate (No. 467) is required for concrete slabs or foundations on grade; optional elsewhere

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Field Testing and Inspections:

1. Code-Required Tests and Special Inspections:
   a. Section 01 45 33 - Code-Required Special Inspections and Procedures, indicates testing scope for code-required testing and special inspections by testing entity retained by Owner or entity for whom Owner is responsible.
   b. Section 03 05 05 - Concrete Testing and Inspection, indicates required testing for concrete Work.
2. Contractor-Performed Field Testing and Inspections:
   a. Where concrete testing and inspection is required by the Contract Documents and is not part of the code-required tests and special inspections by Owner or other entity for whom Owner is responsible, such tests and inspections shall be by Contractor.
   b. Perform concrete testing and inspections in accordance with Section 03 05 05 - Concrete Testing and Inspection.
   c. Aggregates and Other Stockpiled Materials: To ensure stockpiles at the concrete mixing location are not contaminated and otherwise comply with Contract requirements, perform tests on such materials at the concrete ready-mix plant.
   d. Perform strength test on all concrete to which water or superplasticizer, above the amount stated in concrete mix design Submittal approved by Engineer, has been added.
      1) Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

END OF SECTION

SECTION 03 31 31

CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mixing, placing, jointing, and curing of concrete construction.

B. Related Requirements: Include but are not necessarily limited to:

1. Section 03 05 05 - Concrete Testing and Inspection.
2. Section 03 11 13 - Formwork.
3. Section 03 21 00 - Reinforcement.
4. Section 03 31 30 - Concrete, Materials and Proportioning.
5. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
6. Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

A. Terminology:

1. Terminology: Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this Section have the meanings indicated below:
   a. Unless obviously meant or intended otherwise, certain words and terms used in this Section have meanings indicated in ACI CT-13.
   b. “Water-bearing concrete” means concrete surface to be in contact (whether continuously or intermittently) with water, process liquid, or slurries during intended operation of the facility, including, but not limited to, concrete tanks, channels, wet wells, distribution chambers, and secondary containment structures.

B. Reference Standards: Standards referenced in this Section include, but are not necessarily limited to, the following:

1. American Concrete Institute (ACI):
   a. CT-13, Concrete Terminology.
   b. 117, Specification for Tolerances for Concrete Construction and Materials.
   c. 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
   d. 304.2R, Placing Concrete by Pumping Methods.
   e. 305R, Guide to Hot Weather Concreting.
   f. 305.1, Specification for Hot Weather Concreting.
   g. 306R, Guide to Cold Weather Concreting.
   h. 306.1, Standard Specification for Cold Weather Concreting.
   i. 308.1, Specification for Curing Concrete.
   j. 309R, Guide for Consolidation of Concrete.
   k. 318, Building Code Requirements for Structural Concrete and Commentary.
   l. 360R, Guide to Design of Slabs-on-Ground.
2. ASTM International (ASTM):
   a. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   b. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
   c. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.

d. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
e. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
f. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

3. National Ready Mixed Concrete Association (NRMCA):
   a. Checklist for Certification of Ready Mixed Concrete Production Facilities.
4. United States Army Corps of Engineers (USACE):
   a. CRD-C572, Specifications for Polyvinylchloride Waterstop.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate concrete placement Work with other Work, and work of other contractors (if any), that must be installed prior to placement of concrete.
2. Inform other contractors, if any, affected by the concrete Work of intended date(s) of placement of concrete. Provide sufficient advance notice to allow other contractors to perform their work that is to be completed prior to placing of concrete.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Concrete Supplier:
   a. Ready-mix concrete batch plant shall be certified by NRMCA.
   b. Ready mix plant shall comply with NRMCA Checklist for Certification of Ready Mixed Concrete Production Facilities.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Scaled (minimum 1/8 inch per foot) drawings showing proposed locations of construction joints, control joints, expansion joints (as applicable) and joint profile dimensions for each joint type.
   b. Drawing indicating location, size and type of prefabricated waterstop joints.
2. Product Data including:
   a. Manufacturers and types:
      1) Joint fillers.
      2) Curing agents.
      3) Construction joint bonding adhesive.
      4) Prefabricated waterstops.
   b. Acknowledgement that products submitted meet requirements of standards referenced.
3. Samples:
   a. Sample of each type of prefabricated waterstop proposed for the Work, when requested by Engineer.
4. Monitoring Procedures:

B. Informational Submittals: Submit the following:

1. Delivery Tickets:
   a. Copies of concrete delivery tickets.
2. Supplier Instructions:
   a. Procedure for adding high-range water reducer at the Site.

b. Instructions for handling and installing products approved by Engineer.

3. Field Quality Control Submittals:
   a. Results of tests, inspections, and other quality control activities required by the Contract Documents, including Section 03 05 05 - Concrete Testing and Inspections, and this Section's "Field Quality Control" Article performed at the Site.
4. Supplier Site Visit Reports:
   a. Report of each visit to the Site by Supplier, summarizing purpose of visit, activities while onsite, problems encountered, advice given to Contractor or Subcontractor, and actions taken.
5. Special Procedure Submittals:
   a. Description of proposed curing methods.
6. Qualifications:
   a. Ready-mix plant certification, in accordance with this Section's "Quality Assurance" Article.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Concrete Delivery:

1. Prepare a delivery ticket for each load of ready mixed concrete.
2. Truck operator shall hand ticket to Contractor at the time of delivery.
3. Ticket to show:
   a. Mix identification.
   b. Quantity delivered.
   c. Quantity of material in each batch.
   d. Outdoor temperature in the shade at location of concrete placement.
   e. Time at which cement was added.
   f. Time of delivery.
   g. Time of discharge.
   h. Quantity of water that may be added at the site without exceeding the specified water-cement ratio.
   i. Quantity of any water added at the Site.

1.7 PROJECT CONDITIONS

A. Adjust concrete mix design when material characteristics, job conditions, weather, strength test results or other circumstances warrant.

1. Do not use revised concrete mixes until submitted to and approved by Engineer.

1.8 SEQUENCING AND SCHEDULING

A. Do not begin concrete production until proposed concrete mix design has been approved by Engineer.

1. Engineer's approval of concrete mix design does not relieve Contractor of responsibility to provide concrete that meets the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Subject to compliance with the Contract Documents, the manufacturers listed in this article are acceptable.

B. Neoprene Expansion Joint Fillers:

1. Acceptable manufacturers:
   a. Permaglaze.

b. Rubatex.
c. Williams Products.
d. Or equal.

2. Materials:
   a. Closed cell neoprene.
   b. ASTM D1056, Type 2, Class A or C.
   c. Grade: Compression deflection as required to limit deflection to 25 percent of joint thickness under pressure from concrete pour height.

C. Asphalt Expansion Joint Fillers:

1. Acceptable manufacturers:
   a. W.R Meadows.
   b. J and P Petroleum Products.
   c. Or equal.
2. Materials: ASTM D994.

D. Fiber Expansion Joint Fillers:

1. Materials: ASTM D1751.

E. Waterstops, PVC Type:

1. Acceptable manufacturers:
   a. Sika Greenstreak Plastic Products.
   b. W.R Meadows.
   c. Vinylex Corporation.
   d. Bometals, Inc.
   e. Or equal.
2. Materials:
   a. Virgin polyvinyl chloride compound not containing scrap or reclaimed materials or pigment.
   b. Cast-in-place type: USACE CRD-572.
3. Approved profiles as listed.
   a. Construction joints:
      1) Ribbed: 6 inches wide by 3/8 inch.
      2) Sika Greenstreak Plastic Products Style #679, or equal.
   b. Control joints:
      1) 6-inch wide by 3/8 inch thick with ribs and center bulb.
      2) Sika Greenstreak Plastic Products Style #705, or equal.
   c. Expansion joint:
      1) 9 inches wide by 3/8 inch thick center bulb two inch outside diameter.
      2) Sika Greenstreak Plastic Products Style #739, or equal.
   d.
4. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field. Butt welds to be a minimum six inches clear of the intersection.
5. Factory prepunched (less than 1.5 feet on centers, each edge, staggered) for wire supports.
   a. Provide hog rings or grommets at all punched holes along the length of the waterstop.
6. See Drawings for application and other requirements.

F. Waterstops, Preformed Strip Type:

1. Acceptable manufacturers:
    a. Sika Greenstreak Plastics, Inc. (Hydrotite).
    b. Adeka Ultra Seal USA (MC-2010MN).
    c. DeNeef (Swellseal 2010).
    d. Or equal.
    e.
2. Hydrophilic, non-bentonite composition.
3. Manufactured solely for the purpose of preventing water from traveling through construction joints.
4. Volumetric expansion limited to three times maximum.
5. See the Drawings for locations, applications, and other requirements.

G. Water Swelling Sealant:

1. Required adhesive for use with strip-type waterstop.
2. Compatible with strip-type waterstop.
3. Single component, gun applied.
4. Moisture cured.
5. Minimum 70 percent volumetric expansion swelling capability.
    a.

H. Curing Materials shall comply with one or more of the following:

1. Absorbent Covers.
2. Moisture Retaining Covers.
    a. Moisture Retaining Fabric.
3. Dissipating curing compound:
    a. Fugitive dye, waterborne, membrane-forming.
    b. ASTM C309, Type 1D, Class A or B, shall be composed of hydrocarbon resins, and dissipating agents that begin to break down upon exposure to UV light, and traffic, approximately four to six weeks after applications, providing a film that is removable with standard degreasing agents, and mechanized scrubbing actions to not impair the later addition and performance of applied finishes.
    c. Products and Manufacturers:
        1) Dayton Superior Corporation; Day Chem Rez Cure (J-11-WD).
        2) Euclid Chemical Company; Kurez DR VOX.
        3) L&M Construction Chemicals, Inc.; L&M Cure R.
        4) Or equal.
4. Clear, water or solvent-borne, membrane-forming curing and sealing compound:
    a. ASTM C1315, Type 1, Class A.
    b. Moisture loss shall be not more than 0.40 kilograms per square meter when applied at 300 square feet per gallon.
    c. Manufacturer's certification is required.
    d. Subject to Project requirements, provide one of the following products:
        1) Solvent-based:
            a) Euclid Chemical Company; Super Diamond Clear, Luster Seal 300 (exterior), Super Rez-Seal (interior).
            b) L&M Construction Chemicals, Inc.; Lumiseal Plus.
            c) W.R. Meadows, Inc.; CS-309/30.
            d) Or equal.
        2) Water-based:

a) Euclid Chemical Company; Super Diamond Clear VOX.
b) L&M Construction Chemicals, Inc.; Lumiseal WB Plus.
c) W.R. Meadows, Inc.; Vocomp-30.
d) Or equal.

I. Vapor Retarder: Comply with Section 07 26 00 - Under Slab Vapor Retarder.

J. Sand cement grout, non-shrink grout and epoxy grout: Comply with Section 03 31 30 - Concrete Materials and Proportioning.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installing the Work constitutes Contractor's approval of underlying work, substrates, and field conditions prevailing at the time of the Work.

3.2 PREPARATION

A. Preparation – General:

1. Materials and construction shall comply with the tolerances as specified in ACI 117.
2. Complete formwork.
   a. Perform formwork in accordance with Section 03 11 13 - Formwork.
3. Remove earth, snow, ice, water, foreign matter, and other extraneous materials from areas that will receive concrete.
4. Secure reinforcement in place.
   a. Provide reinforcing in accordance with Section 03 21 00 - Reinforcement.
5. Provide expansion joint material, anchors and other embedded items.
6. Prior to placing concrete, obtain Engineer's concurrence that associated formwork and reinforcing appear to be in accordance with the Contract Documents. However, in no event will Engineer's observations, comments, or concurrence that any part of the Work appears to be in accordance with the Contract Documents modify or reduce Contractor's sole responsibility for providing Work in accordance with the Contract Documents.
7. Do not place concrete during rain, sleet, snow, or other adverse ambient or environmental conditions unless adequate protection is provided by Contractor and such placement is acceptable to Engineer.
   a. Provide sufficient quantity of competent, experienced workers with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
   b. Do not allow precipitation or storm water runoff to increase mixing water nor to damage surface finish.
8. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
9. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
   a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.

B. Preparation of Subgrade for Slabs On Ground:

1. Subgrade shall be wetted without standing water immediately prior to placing concrete.
2. Obtain Engineer's acceptance of subgrade compaction density prior to placing slabs on ground.

C. Edge Forms and Screeds:

1. Set accurately to produce designated elevations and contours of finished surface.

2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
3. Use strike off templates, or acceptable vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.3 CONCRETE MIXING

A. Concrete Mixing - General:

1. Provide concrete materials from one ready-mix batch plant qualified in accordance with this Section's "Quality Assurance" Article.
2. Batch, mix, and transport in accordance with ASTM C94/C94M.

B. Control of Admixtures:

1. Control at ready-mix plant:
   a. Admixtures shall be introduced at the ready-mix plant in accordance with manufacturer's recommendations.
   b. Charge admixtures into mixer as solutions.
      1) Measure by means of an appropriate mechanical dispensing device.
      2) Liquid considered a part of mixing water.
      3) Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.
   c. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
   d. Complete performing addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.
2. Control of Admixtures at the Site:
   a. Additional quantities of admixtures (with the exception of retarders) may be added at the Site provided:
      1) Addition of admixtures shall be under the supervision of the ready-mix plant's quality control representative.
      2) Addition of each admixture shall be documented on the delivery ticket.
      3) Provide additional mixing in accordance with ASTM C94.

C. Tempering and Control of Mixing Water:

1. Mix concrete only in quantities for immediate use.
2. Discard concrete which has set.
3. Discharge concrete from ready-mix delivery vehicles within time limit stated in ASTM C94.
4. Addition of water at the Site:
   a. Comply with Section 03 31 30 - Concrete Materials and Proportioning, for specified water cement ratio and slump.
   b. Do not exceed maximum specified water cement ratio or slump.
   c. Incorporate water by additional mixing equal to at least half of total mixing required.

3.4 PLACING OF CONCRETE

A. Placing of Concrete - General:

1. Place concrete as a rate such that concrete, which is being integrated with fresh concrete, is "workable".
   a. Provide sufficient, competent, skilled workers for timely delivery of concrete into forms to avoid unintended cold joints and placement consolidation issues.
2. Comply with ACI 304R,ACI 304.2R, and ACI 301.

3. Do not begin placing concrete during rain, sleet, snow, or other adverse weather or environmental conditions that may be detrimental to concrete placement.
    a. Protect fresh concrete from ensuing inclement weather and other environmental conditions that may be detrimental to concrete.
4. Time between concrete batching and final placement shall not exceed 90 minutes.
    a. Selection of time limit to end of discharge should consider ambient conditions, types of cementitious materials and admixtures used, placement procedures, and projected transportation time between ready-mix plant and the point of delivery.
    b. If discharge is acceptable after more than 90 minutes have elapsed since batching, verify that air content of air-entrained concrete, slump, and temperature of concrete are as specified.
5. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
6. Begin work only when work of other trades affecting concrete is complete.
7. When pumping concrete, do not use excess grout or mortar to lubricate concrete conveyance piping.
8. Do not use excess water for workability or any reason when placing concrete by freefall.
9. Deposit concrete continuously to avoid cold joints.
10. Provide construction joints at locations shown or indicated in the Contract Documents, unless otherwise approved by Engineer via Shop Drawing or Contract modification.
    a. Plan size of crews with due regard for effects of concrete temperature and ambient conditions to avoid unplanned cold joints.
11. Spreaders:
    a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
    b. Embedded:
        1) Obtain approval of Engineer for their use.
        2) Materials: Concrete or metal.
        3) Ends of metal spreaders coated with plastic coating two inches from each end.
12. Deposit concrete as nearly as practicable in its final position to avoid segregation.
    a. Maximum free fall: 4 feet.
    b. Place concrete by means of hopper, “elephant trunk” or tremie pipe extending to within four feet of surface.
13. Perform the following operations before bleeding water has an opportunity to collect on surface:
    a. Spread.
    b. Consolidate.
    c. Straightedge.
    d. Darby or bull float.
14. No water shall be added to the concrete surface to ease finishing operation.
15. Do not discharge water into forms.
16. Consider use of form vibrators for certain placement situations.

B. Cold Weather Concrete Placement:

1. Comply with ACI 306.1.
2. Do not place concrete on forms or subgrades that are below 32 degrees F or contain frozen material.
3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site: in accordance with ACI 306.1.

5. Heat subgrade forms, embedments and reinforcement to between 45 and 70 degrees F, when temperature of surrounding air is 40 degrees F or below at time concrete is placed.
    a. Remove frost from subgrade, forms and reinforcement before concrete is placed.
6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 degrees F.
7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 degrees F.
8. Comply with ACI 306R for specific requirements dealing with elevated steel troweled slabs that will be exposed to freeze-thaw cycles.

C. Hot Weather Concrete Placement:

1. Comply with ACI 305.1.
2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
3. Temperature of concrete at point of delivery (i.e. delivery vehicle discharge) when placed:
    a. Not to exceed 90 degrees F.
    b. Not so high as to cause:
        1) Shrinkage cracks.
        2) Difficulty in placement due to loss of slump.
        3) Flash set.
4. Temperature of forms and reinforcing when placing concrete:
    a. Not to exceed 90 degrees F.
    b. May be reduced by spraying with water to cool below 90 degrees F.
        1) Leave no standing water to contact concrete being placed.
5. Prevent plastic shrinkage cracking, slab curling, or both due to evaporation.

D. Consolidating:

1. Consolidate in accordance with ACI 309R except as modified herein.
2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
    a. Ensure no displacement of reinforcing or other embeds from final position.
    b. Eliminate:
        1) Air or stone pockets.
        2) Honeycombing, pitting, or both.
        3) Planes of weakness.
3. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.
    a. Size and coordinate external vibrators to specifically match forming system used.
4. Internal vibrators:
    a. Minimum frequency of 8000 vibrations per minute.
    b. Insert and withdraw at points approximately 1.5 feet apart.
        1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
    c. Use in:
        1) Beams and girders of framed slabs.
        2) Columns and walls.
        3) Vibrating concrete around all waterstops.
    d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.

5. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other appropriate means.
6. Do not use vibrators to transport concrete within forms.
7. When placing self-consolidating concrete, the use of form or pencil vibrators is acceptable, provided such methods do not cause aggregate segregation, or otherwise adversely affect the quality of the Work.
8. Provide sufficient spare vibrators at the Site during all concrete placing operations to ensure continuous vibration.
9. Bring a full surface of mortar against form by vibration supplemented if necessary by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
10. Prevent construction equipment and machinery, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.

E. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.

1. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94.
2. Temporary horizontal belt conveyors:
    a. Mount at a slope which will not cause segregation or loss of ingredients.
    b. Protect concrete against undue drying or rise in temperature.
    c. Use an arrangement at discharge end to prevent segregation.
    d. Do not allow mortar to adhere to return length of belt.
    e. Discharge conveyor runs into equipment specially designed for spreading concrete.
3. Temporary metal or metal lined chutes:
    a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.
    b. Chutes more than 20 feet long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
    c. Provide end of each chute with a device to prevent segregation.
4. Temporary pumping or pneumatic conveying equipment:
    a. Designed for concrete application and having adequate pumping capacity.
    b. Control pneumatic placement so segregation is avoided in discharged concrete.
    c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1.5 inches.
    d. Do not convey concrete through pipe of aluminum or aluminum alloy.
    e. Provide pumping equipment without Y sections.

F. Placing of Concrete on Metal Deck:

1. Prior to concrete placement, the metal deck shall be free of soil, debris, standing water, loose mill scale, and other foreign matter.
2. Care shall be exercised when placing concrete so that the deck will not be subject to construction loads or impact that exceed the design capacity of the deck.
3. Concrete shall be placed in a uniform manner and spread toward the center of the deck span.
4. If buggies are used to place concrete, runways shall be planked, and buggies shall only operate on planking.
    a. Planks shall be of adequate stiffness to transfer loads to the steel supports without damaging the deck.
5. Deck damage caused by careless placement of concrete shall be repaired or replaced.

6. Pour concrete to the elevations shown or indicated on the Drawings.

3.5 JOINTS AND EMBEDDED ITEMS

A. Construction Joints - General:

1. Provide joints at locations as shown or indicated on the Drawings or as shown on approved Shop Drawings approved by Engineer or in an appropriate Contract modification.
   a. Where construction joint spacing shown on the Drawings exceeds the joint spacing indicated in Paragraph B. below, submit proposed construction joint location in conformance with this Section.
2. Unplanned construction joints are unacceptable.
   a. If concrete cannot be completely placed between planned construction joints, then it must be removed.
3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.
4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
   a. At Contractor's option, beam pockets may be formed into concrete walls.
   b. Size pockets to allow beam reinforcing to be placed as detailed on the Drawings.
5. Place beams, girders, column capitals and drop panels at same time as slabs.
6. Place corbels monolithically with their supporting members.
   a. Locate wall vertical construction joints midway between corbels.
   b. Where only a single corbel is located, place it also monolithically with wall and locate wall vertical construction joint a minimum of three feet from face of corbel.
7. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.
8. Provide the following joints unless shown or indicated otherwise on the Drawings:
   a. Roughen joints: horizontal construction joints.
   b. Keyed joints: vertical construction joints.
9. Roughen construction joints:
   a. Clean the previously hardened concrete interface and remove all laitance.
   b. Intentionally roughen the interface to a full amplitude of 0.25 inch.
10. Keyways:
    a. Construction joint keyways shall have the following dimensions, unless shown or indicated otherwise on the Drawings or as directed by Engineer.
    b. Wall keys:
       1) Keyway width, not less than one-third and not more than one-half the wall thickness measured perpendicular to wall faces.
       2) Keyway depth shall be not less than 1.5 inches.
       3) Continuous along length of wall.
       4) Place keyway in wall center unless otherwise shown or indicated on the Drawings.
    c. Keyways in footings, foundations, base slabs, and structural or elevated slabs:
       1) Keyway height not less than one-third and not more than one-half the footing or slab thickness.
       2) Keyway depth not less than 1.5 inches.
       3) Continuous along footing or slab.
       4) Keyway in footing or slab center unless shown otherwise on the Drawings.
    d. Beam keyways:
       1) Full width of beam.

2) Keyway height not less than 5.5 inches.
3) Keyway depth not less than 1.5 inches.
4) Keyway located in initial beam pour, directly above the bottom reinforcing, unless shown otherwise on the Drawings.

11. Minimum time before placement of adjoining concrete construction:
    a. All concrete: 60 hours, unless otherwise noted.

B. Construction Joints - Spacing Unless Otherwise Specified:

1. Structures not intended to contain liquid:
    a. Wall vertical construction joints:
        1) 50 feet maximum on centers.
        2) At wall intersections, four feet minimum from corner.
    b. Base slab, floor, and roof slab construction joints:
        1) Placements to be approximately square and not to exceed 2,500 square feet.
        2) Maximum side dimension of a slab pour shall be 70 feet.

C. Construction Joints - Bonding:

1. Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance from construction joints.
2. Before new concrete is placed, all construction joints shall be coated with cement grout, or dampened, as indicated below:
3. Roughen construction joints:
    a. Roughen the surface of the concrete to expose the coarse aggregate uniformly with 0.25 inch minimum amplitude.
        1) Remove laitance, loosened particles of aggregate or damaged concrete at the surface.
4. Keyed construction joints:
    a. Thoroughly clean construction joints and remove all laitance.
    b. Dampen the hardened concrete immediately prior to placing of fresh concrete.

D. Slab On Grade Joints:

1. Locate construction and control joints in slabs on grade as shown or indicated on the Drawings.
2. Time cutting properly with set of concrete, if saw cut joints are required or allowed.
    a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.
    b. Complete before shrinkage stresses become sufficient to produce cracking.

E. Expansion Joints:

1. Do not allow reinforcement or other embedded metal items bonded to concrete (except smooth dowels bonded on only one side of joint) to extend continuously through an expansion joint.
2. Use neoprene expansion joint fillers, unless shown or indicated otherwise on the Drawings.
3. Seal expansion joints as shown or indicated on the Drawings.
    a. Comply with Section 07 92 00 - Joint Sealants.

F. Waterstops - General:

1. Waterstop shall be continuous with splices in accordance with manufacturer's instructions and create water tight joints.
2. Do not mix different types of waterstop materials in the same structure without approval from the Engineer unless shown or indicated on the Drawings.

3. Preformed strip type:
    a. Locate waterstop at center of wall, unless shown or indicated otherwise on the Drawings.
        1) Maintain at least three inches from edge of concrete or as recommended by manufacturer.
    b. Install in a bed of swelling sealant on smooth surface of hardened concrete by use of nails, adhesive or other means as recommended by manufacturer to prevent movement of waterstop during placement of concrete.
    c. Roughened joints shall be specially prepared during concrete placement to provide smooth surface for proper water stop installation.
    d. Use in joints against existing concrete where shown or indicated on the Drawings.
4. PVC waterstops:
    a. Pre-position waterstop accurately in joints, with adequate clearance from all reinforcing. Do not push waterstop into wet concrete.
    b. Secure waterstops in correct position using hog rings or grommets spaced no more than 1.5 feet maximum staggered along each edge full length and passed through the edge of the waterstop.
        1) Tie wire to adjacent reinforcing.
    c. Hold horizontal waterstops in place with continuous supports.
    d. Install according to manufacturer's instructions.
        1) Do not displace reinforcement from required location.
    e. Splice ends and intersections with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.
        1) Use factory fabricated "T" and corner intersection fittings.
        2) Field splice straight runs of material.
    f. Unless otherwise noted, provide for construction joints in new construction for all structures indicated on the Drawings.

G. Other Embedded Items:

1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.
2. Do not route electrical conduit, drains, or pipes in concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Engineer.

H. Placing Embedded Items:

1. Support against displacement.
2. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
3. Provide adequate means for anchoring waterstop in concrete.
    a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.

3.6 FINISHING

A. Comply with Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.

B. Coordinate mixing and placing with finishing.

3.7 INSTALLATION OF GROUT

A. Grout Schedule:

1. Sand cement grout:
    a. Fill keyways in precast HCU.

b. Construction joint bedding (base of wall pours with comparable compressive strength to wall).
c. General use.
d. As shown or indicated on the Drawings.

2. Non-shrinking non-metallic grout:
a. Filling form tie holes.
b. Under column and beam base plates.
c. Other uses shown or indicated on the Drawings.

3. Epoxy grout:
a. Patching cavities in concrete.
b. Grouting of dowels and anchor bolts into existing concrete.
c. Grouting of rotating or oscillating equipment base plates where driving motor is 500 horsepower and above.
d. As shown or indicated on the Drawings.

B. Grout Installation:

1. Sand cement grout:
a. Fill wetted keyways between precast concrete hollow core slabs with sand cement grout.
b. Consolidate grout by rodding or by other means to assure complete filling of keyways.
c. Cure grout by one of methods specified.

2. Non-shrink non-metallic grout:
a. Clean concrete surface to receive grout.
b. Saturate concrete with water for 24 hours prior to grouting.
c. Mix in a mechanical mixer.
d. Use no more water than necessary to produce flowable grout.
e. Place in accordance with manufacturer's instructions.
f. Provide under beam, column, and equipment base plates, in joints between precast concrete and cast-in-place slabs, and in other locations shown or indicated on the Drawings.
g. Completely fill spaces and cavities below the top of base plates.
h. Provide forms where base plates and bed plates do not confine grout.
i. Where exposed to view, finish grout edges smooth.
j. Except where a slope is shown or indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.

3. Epoxy grout:
a. Mix and place in accordance with manufacturer's written instructions.
b. Apply only to clean, dry, sound surface.
c. Completely fill cavities and spaces around dowels and anchors without voids.
d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
e. Obtain manufacturer's field technical assistance as necessary to ensure proper placement.

3.8 CURING AND PROTECTION

A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical damage immediately after placement, and maintain with minimal moisture loss at relatively

constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.

1. Comply with ACI 308.1 except as modified herein.
2. Do not impose loads by foot traffic, wheeled traffic, and other loads until concrete has sufficiently cured to carry imposed loads without adversely affecting the concrete. In no event shall concrete be subject to loading or traffic during initial 48 hours of curing, unless otherwise approved by Engineer.

B. Apply one of the following curing procedures immediately after completion of placement and finishing (surfaces not in contact with forms).

1. Ponding or continuous sprinkling. Avoid eroding the surface of freshly placed concrete.
2. Application of wet Absorbent Covers:
    a. Minimum lap: 12 inches.
    b. Provide continuous uniform supply of moisture, such as sprinklers or soaker hoses as necessary to keep concrete surface continuously wet.
    c. Monitor Absorbent Covers as required to prevent cover materials or concrete surface from drying out.
3. Continuous application of steam (not exceeding 150 degrees F) or mist spray.
4. Application of Moisture Retaining Cover sheet materials.
    a. Place as soon as possible after final finishing and without marring the surface.
    b. Minimum lap: 12 inches.
    c. Seal edges to make water-tight.
    d. Place Moisture Retaining Cover in intimate contact with the concrete surface, without wrinkles and weighted to hold in place.
    e. Hold cover and edges in place as necessary to prevent wind from displacing the cover.
    f. Moisture Retaining Fabric:
        1) Install in accordance with manufacturer’s written recommendations.
        2) Saturate concrete surface and fabric side of cover immediately prior to placing.
    g. Monitor continuously during the curing period:
        1) Repair holes, tears or displaced cover.
        2) Rewet as necessary to keep concrete moist under cover.
5. Application of other moisture retaining covering acceptable to Engineer.
6. Water used for curing shall be within 20 degrees F of the concrete temperature.
7. Application of a curing compound.
    a. Apply curing compound in accordance with manufacturer's written recommendations immediately after any water sheen, which may develop after finishing, has disappeared from concrete surface.
    b. Do not use on surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.
    c. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two coats of the curing compound.
        1) Apply the first coat of curing compound to a vertical surface immediately after form removal.
        2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
        3) Allow the preceding coat to completely dry prior to applying the next coat.
        4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.
8. Surfaces In Contact with Forms:

a. Formed surfaces: Cure formed concrete surfaces utilizing final curing methods per ACI 308.1, including underside of beams, supported slabs, and other similar surfaces,
   1) See Section 03 11 13 - Formwork.
b. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to heating by sun by keeping forms wet and cool until they can be safely removed.
c. Make provisions to keep concrete wall moist while stripping forms and until curing measures are in place.
d. After form removal, cure concrete until end of time prescribed.
e. Use one of the methods listed above.
f. Forms left in place shall not be used as a method of curing in hot weather.
g. The term "hot weather", where used in these Specifications, is defined in ACI 305.1.
h. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.

C. Curing Period:
1. Continue curing for at least seven days for all concrete except Type III, high early strength concrete for which period shall be at least three days.
   a. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is two days old, provided concrete is not permitted to become surface dry during transition.

D. Cold Weather:
1. Comply with of ACI 306.1.
2. Maintain temperature of concrete in accordance with ACI 306.1 for a minimum of 72 hours after concrete is placed, when outdoor temperature is 40 degrees F, or less.
   a. Maximum temperature rate of decrease: In accordance with ACI 306.1.
3. Provide temporary heating, covering, insulating, or housing of the concrete Work to maintain required temperature without damage due to concentration of heat.
4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.

E. Hot Weather:
1. Comply with ACI 305.1 and ACI 308.1.
2. Provide as necessary cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.
4. Maximum temperature rate of decrease: In accordance with ACI 305.1.

F. Rate of Temperature Change:
1. Maintain temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing.

G. Protection from Mechanical Damage:
1. Protect concrete from damage of all types, whether or not mechanically imparted including load stresses, heavy shock, and excessive vibration.
2. Protect finished concrete surfaces from all types of damage, including damage by construction equipment and machinery, construction means and methods, precipitation, and running water.
3. Do not load self-supporting structures in such a way as to overstress concrete.

3.9 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Special Inspections in accordance with building code:
    a. Comply with Section 01 45 33 - Code-Required Special Inspections and Procedures, and 03 05 05 - Concrete Testing and Inspection.

B. Supplier’s Onsite Services:

1. Waterstop manufacturer's representative shall provide on-site training of waterstop installation, field splicing, welding and inspection procedures prior to construction.

END OF SECTION

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SECTION 03 35 00
CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Concrete Finishing and Repair of Surface Defects, as indicated, in accordance with provisions of Contract Documents.

1.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. ASTM E1155 Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers
2. ACI 302.1R Guide for Concrete Floor and Slab Construction

B. Floor Finish Tolerances:

1. Follow F-Number System as defined in ASTM E1155.
   a. Floor Flatness F-Number: F_F defines maximum floor curvature allowed over 24 inches computed on basis of successive 12 inches elevation differentials.
   b. Floor Levelness F-Number: F_L defines relative conformity of floor surface to a horizontal plane measured over a 10 feet distance.
   c. Above number pair to be stated in form: F_F/F_L.
   d. Specified Overall Value (SOV) is enumerated and is based on composite of measured values in a placement.
   e. Minimum Local Value (MLV) describes flatness or levelness below which repair or replacement is required. MLV is based on individual placement and applies to minimum local area not crossing construction or control joints.

C. Trial Concrete Panels:

1. Provide trial panels to permit evaluation of finishing properties and appearance of concrete proposed for use.
2. Panels size: 8 x 8 feet of specified thickness, and made with specified materials and proportions, using equipment and personnel comparable to those employed on work.
3. Demonstrate concrete capable of being finished at a slump not exceeding that specified.
4. Construct panels and secure approval prior to proceeding with finish in specified location.
5. Approved panels shall serve as standards by which corresponding finishes in structure will be accepted or rejected.
6. Construct panels at approved location, not as part of structure. Protect from construction operations, weather, and damage until acceptance of completed concrete work. Remove from site when directed.
   a. Provide one 4 inches thick approved panel for each slab finish specified. Panel shall be on grade.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Chemical Hardener:

1. Base:

a. Master Builders Solutions.

2. Optional:

a. SpecChem, LLC

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Bonding Agent:

1. Approximately 1 part Portland cement to 1 part fine sand passing a No.30 mesh sieve.
2. Mix to consistency of thick cream.

B. Patching Compound:

1. Same materials and approximately same proportions as used for concrete, except omit coarse aggregate.
2. Shall consist of not more than 1 part Portland cement to 2-1/2 parts sand by loose volume.
3. For exposed concrete, part of Portland cement shall be white to produce a color matching color of surrounding concrete, as determined by a trial patch.
4. Add no more water than necessary for handling and placing.
5. Mix compound in advance and allow to stand with frequent manipulation, without addition of water, until it has reached stiffest consistency that will permit placing.

C. Grout Mix:

1. Cleaned rubbed finish:

a. Mix 1 part Portland cement and 1-1/2 parts fine sand with sufficient water to produce a grout with a consistency of thick paint.

2. Cork floated rubbed finish:

a. Mix 1 part Portland cement and 1 part fine sand with sufficient water to produce a stiff grout.

D. Proprietary Materials:

1. Contractor's option: Proprietary compounds for adhesion, patching, or finishing may be used in lieu of or in addition to foregoing grouts.
2. Use such compounds in accordance with manufacturer's recommendations.

PART 3 - EXECUTION

3.1 FINISHING

A. After removal of forms, repair and give surfaces of concrete finishes indicated.

1. Top surface of slabs not included.

B. Unspecified finish: If finish is not designated, use following finishes as applicable:

1. Unpainted concrete surfaces not exposed to public view: Rough form finish.
2. Unpainted concrete surfaces exposed to public view: Smooth form finish.
3. Concrete surfaces to receive paint: Grout cleaned rubbed finish.
4. Unformed surfaces (except slabs): As indicated.

3.2 REPAIR OF SURFACE DEFECTS

A. Repair surface defects immediately after form removal.

B. Remove honeycombed and other defective concrete down to sound concrete.

C. Chip if necessary to make edges perpendicular to surface or slightly undercut.

D. No feather edges will be permitted.

E. Dampen area to be patched and an area at least 6 inches wide surrounding it to prevent absorption of water from patching compound.

F. After surface water has evaporated from area to be patched, brush bonding agent into surface.

G. When bonding agent begins to lose water sheen, apply patching compound.

H. Thoroughly consolidate compound into place and strike off so as to leave patch slightly higher than surrounding surface.

I. To permit initial shrinkage, leave undisturbed for at least 1 hour before final finish. Keep patched area damp for 7 days.

J. Do not use metal tools in finishing a patch which will be exposed.

K. Tie holes:

1. Unless stainless steel, non-corrosive, or acceptably coated ties are used, tie holes shall be filled.
2. Clean and thoroughly dampen tie holes; fill solid with patching compound.

3.3 AS-CAST FINISHES

A. Rough Form Finish:

1. No selected form facing materials are specified for rough form finish surfaces.
2. Concrete surfaces shall conform to tolerances in f 03 11 00 Concrete Formwork.
3. Patch defects and tie holes.
4. Chip or rub off fins exceeding 1/4 inches in height.
5. Leave surfaces with texture imparted by forms.

B. Smooth Form Finish:

1. Use form facing material to produce a smooth, hard, uniform texture on concrete.
2. Arrange facing material orderly and symmetrical, with number of seams kept to practical minimum.
3. Support by studs or other backing capable of preventing excessive deflection.
4. Do not use material with raised grain, patches, or other defects which will impair texture of concrete surface.
5. Patch tie holes and defects.
6. Remove fins completely.
7. When surface textures are impaired and form joints misaligned by more than 1/8 inches grind bush hammer, or otherwise correct affected concrete.
8. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete.
9. Repair major mortar leakage as a defective area.

C. Special Architectural Finish:

1. Produce finish in accord with requirements of Section 03 35 00, Polished Concrete Finish.

D. Unformed Surface Finish:

1. Strike smooth tops of walls or buttresses, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces after concrete is placed.
2. Float to a texture reasonably consistent with that of formed surfaces.
3. Continue final treatment on formed surfaces uniformly across unformed surfaces.
4. Not intended for slabs.

3.4 RUBBED FINISHES

A. General:

1. Form and repair concrete surfaces to receive rubbed finishes, in accordance with requirements for smooth form finish.
2. Remove forms and perform necessary patching as soon after placement as possible without jeopardizing structure.

B. Smooth:

1. Produce smooth rubbed finish on newly hardened concrete no later than day following form removal.
2. Wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.
3. Use no cement grout other than cement paste drawn from concrete itself by rubbing process.

C. Grout Cleaned:

1. Undertake no cleaning operations until contiguous surfaces are completed and accessible.
2. Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly.
3. Immediately after applying grout, scrub surface vigorously with a cork float or stone to coat surface and fill air bubbles and holes.
4. While grout is still plastic, remove excess grout by working surface with a rubber float, sack, or other means.
5. After surface whitens from drying, rub vigorously with clean burlap.
6. Keep finish damp for at least 36 hours after final rubbing.

D. Cork Floated:

1. Remove forms at an early stage, within 2 to 3 days of placement where possible.
2. Remove ties.
3. Remove burrs and fins.
4. Dampen wall surface.
5. Apply grout with firm rubber float or with trowel, filling surface voids.
6. Compress grout into voids.
7. If grout surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with a fog sprayer.
8. Produce final texture with a cork float using a swirling motion.

3.5 SLAB FINISHING

A. General:

1. Place slabs to finish tolerances specified.
2. Slab finish: Use following finishes at building locations noted.
   a. Scratched finish: Surfaces intended to receive bonded applied cementitious applications, such as setting beds, grout, etc.
   b. Floated finish (magnesium):
      1) Surfaces in which no other covering is specified.
   c. Troweled finish:
      1) Floors intended as walking surfaces or to receive floor coverings.
   d. Non-slip finish (interior and exterior): Ramps, docks, stairs specifically noted on drawings.

B. Finishing tolerances:

1. For shored construction, measurements for conformance with finishing tolerances shall be made as soon as slab can tolerate foot traffic, and before shores are removed.

2. The F_L levelness tolerance is not applicable to unshored form work such as cast in place topping on prestressed tees, slabs on unshored steel and metal deck, or unshored, post-tensioned slabs on steel beams.
3. Horizontal finishes will be accepted provided:
    a. Applicable specification requirements are satisfied.
    b. Water does not pond in areas sloped to drain.
    c. Floor finish tolerances F_F/ F_L conforms to that specified for particular finish and Minimum Local Values are not less than 75 percent of the floor finish tolerance specified.
4. Accumulated deviation from intended true plane of finished surface does not exceed 1 inch.
5. Accuracy of floor finish does not adversely affect installation and operation of movable equipment, floor supported items or items fitted to floor.

C. Finishes:

1. Scratched finish:
    a. After concrete has been placed, consolidated, struck off, and leveled to a F_F15/ F_L13 tolerance, roughen surface with stiff brushes or rakes before final set.
2. Floated finish:
    a. After concrete has been placed, consolidated, struck off, and leveled, do not work further until ready for floating.
    b. Using a magnesium float, begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit operation.
    c. During or after first floating, check planeness of entire surface with a 10 foot straightedge applied at not less than two different angles.
    d. Cut down high spots and fill low spots during this procedure to produce a surface within F_F20/ F_L15 tolerance throughout.
    e. Refloat slab immediately to a uniform sandy texture.
3. Troweled finish:
    a. Sequence:
        1) Float finish.
        2) Power trowel
        3) Hand trowel
    b. First troweling after power floating shall produce a smooth surface which is relatively free of defects but which may still indicate some trowel marks.
    c. Final trowel when a ringing sound is produced as trowel is moved over surface.
    d. Thoroughly consolidate surface by hand troweling.
    e. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to F_F25/ F_L20 tolerance.
    f. On surfaces intended to receive floor coverings, grind off defects which would indicate through floor covering.
    g. On surfaces intended to receive waterproofing membranes grind off defects that might tear or otherwise damage membrane.
4. Broom or belt finish:
    a. Immediately after concrete has received float finish, give it a coarse scored texture by drawing a broom or burlap belt across surface transverse to slope or traffic flow.
5. Non-slip slab finish:
    a. Aggregate: Crushed, ceramic bonded aluminum oxide particles. Apply at 25 pound per 100 square feet.
    b. Blend aggregate with Portland cement in proportions recommended by manufacturer of aggregate.

c. Give surface a float finish.

d. Apply approximately two-thirds of blended material for required coverage to surface by a method that ensures even coverage without segregation.

   1) Begin floating immediately.

e. After material has been embedded by floating, apply remainder of blended material to surface at right angles to previous application.

f. Make second application heavier in areas not sufficiently covered by first application. Follow with second floating immediately.

g. After selected material has been embedded by two floatings, complete operation with a broomed finish.

END OF SECTION

SECTION 03 35 43
POLISHED CONCRETE FINISHING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Polished Concrete Floor, as indicated, in accordance with provisions of Contract Documents.

B. Related Requirements: Include, but are not necessarily limited to:

1. Section 03 35 00 – Concrete Finishing.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:

1. Experienced in specified requirements and methods for Work of this section.
2. Provide letter from concrete finish manufacturer stating installer is an approved applicator of special concrete finishes and is familiar with procedures and installation requirements required by manufacturer.

B. ASTM International (ASTM):

1. ANSI 137,1

C. ASTM International (ASTM):

1. ASTM C779 Standard Test Method for Abrasion Resistance of Horizontal Concrete Surfaces
2. ASTM C805 Standard Test Method for Rebound Number of Hardened Concrete
3. ASTM D4039 Standard Test Method for Reflection Haze of High-Gloss Surfaces
4. ASTM D5767 Standard Test Method for Instrumental Measurement of Distinctness-of-Image (DOI) Gloss of Coated Surfaces

D. American Concrete Institute (ACI):

1. ACI 302 1R-89 Guide for Concrete Floor and Slab Construction.

E. American Society of Concrete Contractors (ASCC):

1. Concrete Polishing Council Aggregate Exposure Chart.
2. Concrete Polishing Council Polished Concrete Appearance Chart.

F. Protection:

1. Do not place steel on slabs to avoid rust staining.
2. Do not allow acids and acidic detergents to come in contact with slab.
3. Do not use pipe cutting machines on floor slab.
4. Diaper hydraulic powered equipment to avoid staining of concrete.
5. Do not park vehicles on inside slab.
    a. If necessary to complete Work, place impervious drop cloths under vehicles.

G. Mock-up:

1. Apply mock-up of each finish, to demonstrate typical joints, surface finish, color variation, and standard of workmanship.
    a. Construct mock-ups approximately 50 square feet in location indicated or as directed by Architect.
    b. Obtain Architect approval of mock-up before starting construction.

c. If mock-ups do not meet requirements, demolish and remove from site and cast additional mock-up until approved.
d. Maintain mock-up during construction in undisturbed condition as standard for judging completed work.
e. Approved mock-ups may become part of completed work if undisturbed at time of substantial completion.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer's specifications and test data, describing specified product.
2. Recommended installation procedures.
3. Concrete finish technical data sheet including descriptive data, curing time, and application requirements.

B. Samples:
1. Color and finish.

C. Project Information:
1. Certified test reports, prepared by an independent testing laboratory, confirming compliance with specified performance criteria.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Polished Concrete Floor:
1. Base:
a. Advanced Floor Products.
2. Optional:
a. Laticrete
b. Prosoco.
c. LM Scofield.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIAL

A. Reactive Stabilizer:
1. Base Product: Retro Plate 99 by Advanced Floor Products.
2. Silicate concrete hardener.
3. Nonflammable.
4. Water based.
5. Abrasion: 400% increase in resistance.
6. Hardness: 21% increase in impact strength.
7. Exposure: Class A as defined by the Concrete Polishing Council Aggregate Exposure Chart.
8. Floor finish: Level 2 as defined by the Concrete Polishing Council Polished Concrete Appearance Chart.
9. Light reflectivity: 30% increase.
10. Dynamic coefficient of friction: Greater than 0.42 per ANSI 137.1.

B. Neutralizing Agent:
1. Trisodium phosphate.

C. Water:

1. Potable.

D. Sealer:

1. Base Product: RetroPel by Advanced Floor Products.
2. Oil and water repellent.
3. Does not affect floor appearance.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Finish slabs to surface requirements specified in Section 03 35 00 Concrete Finishing.

B. Comply with manufacturers written instructions for substrate temperature and moisture content, ambient temperature and humidity, ventilation, and other conditions affecting topping performance.

C. Close areas to traffic during floor application and after application, for time period recommended in writing by manufacturer.

D. Examine substrate, with installer present, for conditions affecting performance of finish.

1. Correct conditions detrimental to Work.
2. Do not proceed until unsatisfactory conditions are corrected.
3. Verify base slab meet finish and surface profile requirements in Division 3.

E. Prior to application, verify floor surfaces are free of construction laitance.

3.2 JOINTS

A. Construction Joints - General:

1. Provide joints at 10’-0” maximum centers as shown on the Drawings or as shown on approved Shop Drawings approved by Engineer or in an appropriate Contract modification.
   a. Submit proposed construction joint location plan for approval by Engineer

3.3 APPLICATION

A. Apply in accord with manufacturer’s instructions.

B. Start floor finish applications in presence of manufacturer’s technical representative.

C. Sealing, Hardening and Polishing of Concrete Surface:

1. Concrete must be in place a minimum of 45 days or as directed by the manufacturer before application can begin.
2. Apply a minimum of 10 days prior to installation of fixed equipment, furniture, or accessories.
3. Follow procedures recommended by product manufacturer and to match approved mock-up.
4. Polish to required sheen level.

3.4 CLEAN UP

A. Keep work area clean and free of debris.

B. Repair damages to surface caused by cleaning operations.

C. Remove spatter from adjoining surfaces.

D. Dispose of materials in accordance with local regulations.

3.5 PROTECTION

A. Protect finished work until fully cured.

END OF SECTION

DIVISION 04

MASONRY

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SECTION 04 01 20
MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry cleaning.

B. Related Sections include but are not necessarily limited to:

1. Section 04 22 00 - Concrete Masonry.

1.2 QUALITY ASSURANCE

A. Qualifications:

1. Use experienced workmen familiar with product and its application.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Manufacturer's application instructions.
   b. Manufacturer's dilution recommendations.
   c. Manufacturer's recommendations on neutralizing rinse.

B. Certifications:

1. Certification that Contractor is experienced in this type of masonry cleaning.
2. Certificate from cleaning solution manufacturer stating that product being used is compatible with and is intended for use on masonry units.
   a. Outline necessary precautions to be taken during cleaning operation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Cleaning solution, detergent type:
   a. PROSOCO, Inc.
   b. Diedrich Technologies, Inc.
2. Cleaning solution for manganese or vanadium stained masonry:
   a. PROSOCO, Inc.
   b. Diedrich Technologies, Inc.

2.2 MATERIALS

A. Detergent-Type Cleaning Solution: PROSOCO, Inc. "Sure Klean #600 inches detergent masonry cleaner.

B. Manganese or Vanadium-Stained Masonry: PROSOCO, Inc. "Vanatrol."

C. Water: Potable.

D. Neutralizing rinse as required by manufacturer.

2.3 MIXES

A. Dilute cleaning solution with potable water at rate which will provide for the weakest solution allowable for cleaning wall.

B. If project conditions require solution of greater than 5% acid, obtain permission from Engineer in writing prior to applying solution to wall surface.

PART 3 - EXECUTION

3.1 PREPARATION

A. Allow seven days after completion of masonry work before start of cleaning.

B. Remove excess mortar using wooden paddles and scrapers.

C. Protect adjacent surfaces not to be cleaned.

3.2 APPLICATION

A. Protect adjacent surfaces subject to potential damage by cleaning solution.

B. Apply masonry cleaner to exposed-to-view masonry surfaces.

1. Do not use wire brushes.
2. Use only tools free of rust.
3. Apply solution using fibered wall-washing brush.

C. Thoroughly rinse and pre-soak walls.

D. Flush all loose mortar and dirt from surface.

E. Wet to prevent "run-off" streaking.

F. Scrape off mortar and reapply cleaning solution.

G. After scrubbing, clean thoroughly with pressurized water.

H. Apply neutralizing rinse as recommended by manufacturer.

END OF SECTION

SECTION 04 05 13
MASONRY MORTAR AND GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar.
2. Masonry grout.
3. Integral water repellent admixture.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 04 22 00 - Concrete Masonry.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C143/C143M, Standard Test Method for Slump of Hydraulic-Cement Concrete.
   b. C144, Standard Specification for Aggregate for Masonry Mortar.
   c. C150/C150M, Standard Specification for Portland Cement.
   d. C207, Standard Specification for Hydrated Lime for Masonry Purposes.
   e. C270, Standard Specification for Mortar for Unit Masonry.
   f. C404, Standard Specification for Aggregates for Masonry Grout.
   g. C476, Standard Specification for Grout for Masonry.
   h. C1019, Standard Test Method for Sampling and Testing Grout.
   i. C1093, Standard Practice for Accreditation of Testing Agencies for Masonry.
   j. C1384, Standard Specification for Admixtures for Masonry Mortars.
2. The Masonry Society (TMS):
   a. 602, Specification for Masonry Structures.

B. Qualifications:

1. Preconstruction Testing Laboratory shall be an independent agency qualified in accordance with ASTM C1093 for performing the testing indicated.
   a. Testing Laboratory shall have a minimum of 10 years of experience in the testing of mortar and grout.
   b. Technician conducting tests shall have minimum of five years of experience in the testing of mortar and grout.

C. Mock-Ups:

1. Provide mortar and grout for mock-up specified in Specification Section 04 22 00.

1.3 DEFINITIONS

A. Coarse grout and fine grout are defined by the aggregate size used in accordance with ASTM C476.

B. Coarse aggregate and fine aggregate are defined in ASTM C404, Table 1.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:

a. Acknowledgement that products submitted meet requirements of standards referenced.
b. General:
1) Product data for cementitious materials.
2) Source or producer of aggregates and gradation.
3) Integral water repellent manufacturer's dosage rate.
c. Proposed mortar mix design:
d. Proposed masonry grout mix design.
2. Test results:
a. Preconstruction mortar test results.
b. Preconstruction masonry grout test results.

B. Informational Submittals:
1. Qualifications of testing lab and technician.
2. Test results and inspection reports per Specification Section 01 45 33.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location.
1. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mixes in moisture-resistant containers.
1. Store preblended, dry mixes in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement:
1. ASTM C150/C150M, Type I or II.
2. No air entrainment.
3. Natural color.
4. Maximum percent of alkalis: 0.60 in accordance with ASTM C150/C150M, Table 2.

B. Hydrated Lime:
1. ASTM C207, Type S.
2. Type SA not acceptable.
3. Lime substitutes are not acceptable.

C. Mortar Aggregate: ASTM C144, free of gypsum.

D. Grout Aggregate: ASTM C404.

E. Water: Potable.

F. Integral Water Repellent Admixture:
1. Liquid polymeric admixture: ASTM C1384.
2. Verify compatibility with liquid water repellent admixture being used in the fabrication of concrete masonry units.

2.2 MIXES

A. Mortar and grout shall comply with TMS 602 and building code.

B. Type "S" mortar shall be used:

1. Comply with ASTM C270, Table No. 1, Cement-Lime Mortar.
    a. Do not use masonry cement or mortar cement.
    b. No fly ash additives will be accepted.
2. Mix materials minimum of three minutes and maximum of five minutes.
3. Adjust consistency to satisfaction of mason.
4. Do not use admixtures unless otherwise indicated.
5. Provide integral water repellent admixture in mortar used for:
    a. Exterior concrete masonry work.
    b. Interior concrete masonry work in wet areas.
6. Do not use integral water repellent admixture in mortar for brick.

C. Masonry Grout:

1. ASTM C476.
    a. Minimum 28-day compressive strength: 2,000 psi.
    b. Slump: 8 to 11 inches.
2. Mix 5 minutes minimum.
3. No admixtures allowed.
4. At Contractor's option, premixed or preblended grout meeting the above minimum requirements may be used.

2.3 SOURCE QUALITY CONTROL

A. Perform preconstruction laboratory tests on proposed masonry mortar and grout prior to start of masonry work.

1. Perform tests far enough in advance so that any necessary retesting can be accomplished before masonry construction begins.
    a. Test mortar per ASTM C270.
    b. Test grout per ASTM C1019.

B. Source Limitations for Mortar Materials:

1. Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from a single manufacturer for each cementitious component and from one source or producer for each aggregate.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and TMS 602.

B. Mortar:

1. If standard gray mortar begins to stiffen, it may be retempered by adding water and remixing unless prohibited by water repellent admixture manufacturer.
    a. Standard gray mortar shall not be retempered more than one time.
2. All mortar must be used within 2-1/2 hours maximum after initial mixing per TMS 602.
3. Engineer reserves right to alter mix design based on initial rate of absorption of masonry units.

C. Masonry Grout:

1. Use grout within 1-1/2 hours maximum after initial mixing.
2. Use no grout after it has begun to set.
3. Do not retemper grout after initial mixing.
4. Place grout in lifts not exceeding 4 feet.

5. Use coarse grout in spaces with least dimension over 2 inches.
6. Consolidate all grout while installing.
    a. Consolidate grout pours 12 inches or less in height by mechanical vibration or by puddling.
    b. Consolidate grout pours exceeding 12 inches in height by mechanical vibration and reconsolidate by mechanical vibration after initial water loss and settlement has occurred.

3.2 FIELD QUALITY CONTROL

A. Masonry Mortar and Grout Testing and Inspection:

1. Testing and inspection services will be provided by the Owner's special masonry inspector.
    a. Do not include in the bid price the cost of these services.
2. Testing and inspection shall include, but is not limited to:
    a. Observe proportions of site-prepared mortar and grout.
    b. Observe grout space prior to grouting.
    c. Grout compressive strength sampling, testing and reporting per ASTM C1019.
        1) One strength test shall be the average of three specimens from the same sample, tested at 28 days.
    d. Grout slump test sampling, testing, and reporting per ASTM C143/C143M.
    e. Frequency of sampling: One sample (three specimens) collected each grouting operation during masonry construction.
3. Reporting: Special inspector to submit test results and inspection reports per Specification Section 01 45 33.

END OF SECTION

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry accessories.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 04 22 00 - Concrete Masonry.
2. Section 05 50 00 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A951, Standard Specification for Steel Wire for Masonry Joint Reinforcement.
   c. A1008, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   d. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   e. D412, Standard Test Method for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
   f. D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
   g. D2000, Standard Classification System for Rubber Products in Automotive Applications.
   h. D2240, Standard Test Method for Rubber Property—Durometer Hardness.

B. Mock-Ups:

1. Provide specified products for inclusion into mock-up panels required by Specification Section 04 22 00.
2. Coordinate with built-in items and veneer coursing.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Tear resistance of flashing material.
   d. Manufacturer's recommendations for flashing adhesive.
   e. Manufacturer's data sheet on each product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Weep vents for cavity wall construction:
    a. Heckman Building Products Inc.
    b. Hohmann & Barnard, Inc.
    c. Wire Bond.
    d. Mortar Net USA, Ltd.
2. Reglets:
    a. Hohmann & Barnard, Inc.
    b. Heckmann Building Products.
    c. Superior Concrete Accessories, Inc.
3. Masonry anchors, horizontal joint reinforcing and miscellaneous anchors:
    a. Heckman.
    b. Hohmann & Barnard, Inc.
    c. Wire Bond.
4. Thru wall flashing:
    a. EPDM:
        1) Carlisle Syntech Systems, Inc.
        2) Holcim Elevate.
    b. Stainless steel:
        1) Heckman Building Products.
        2) Hohmann & Barnard, Inc.
5. Weep joint mortar protection system:
    a. Mortar Net USA, Ltd.
    b. Hohmann & Barnard, Inc.
    c. Wire Bond.
6. Preformed control joint inserts:
    a. Hohmann & Barnard, Inc.
    b. Wire Bond.
7. Grout screen:
    a. Wire Bond.
    b. Heckman Building Products.
    c. Hohmann & Barnard, Inc.

2.2 MANUFACTURED UNITS

A. Thru Wall Flashing and Stainless Steel Drip:

1. 40 mil EPDM manufactured specifically for thru wall flashing.
    a. Tear resistance: ASTM D624, 150 pound/IN minimum.
    b. Width as necessary.
        1) Provide single piece full width, no horizontal joints will be allowed unless approved in writing by Engineer.
    c. Factory precut wherever possible.
    d. Factory fabricated inside corners, outside corners, and end dams.
2. Stainless steel drip:
    a. ASTM A666, Type 316.
    b. Finish: ASTM A480, 2D.
    c. Minimum 26 GA.
    d. Maximum lengths of 10 feet.
        1) Extend horizontally the full depth of veneer.

e. Factory fabricated.
f. Factory fabricated inside and outside corners with a minimum return of 16 inches on each leg.
1) Weld all joints and grind smooth.
g. Provide 1/2 inches drip leg on exterior side of wall.
h. Refer to the Drawings for profile.
i. Lap sealant: VULKEM 922.

B. Flashing Adhesive: As recommended by flashing manufacturer for sealing laps, sealing to vertical masonry and concrete surfaces and sealing to stainless steel surfaces.

C. Weep Vent:
1. 90% open mesh vent designed to be placed in vertical mortar joint.
2. Mortar Net USA, Ltd. "Mortar Net Weep Vents."
3. Color: Gray.

D. Reglets:
1. Products specified are manufactured by Hohmann & Barnard, Inc.
2. For concrete construction: Type #CR - Concrete Reglet.

E. Mechanical Veneer Anchoring System for Stud Back-up:
1. Minimum 3-1/2 inches vertical adjustment.
2. 14 GA hot-dipped galvanized anchor plate punched at top and bottom for attachment to stud wall back-up.
3. Minimum 3/16 inches "V" shaped wire tie x length necessary to provide minimum 2 inches embed into veneer mortar joint.
4. Self-drilling self-tapping Type 410 stainless steel fasteners with neoprene sealing washers.
a. Minimum #12-16 x 1-1/2 inches hex washer head.
5. Hohmann & Barnard, Inc. "DW-10 inches Series.

F. Horizontal Joint Reinforcing:
1. General:
a. Conform to ASTM A951.
b. Cold drawn steel wire, ASTM A82.
c. 9 GA side rods.
d. 9 GA cross rods.
e. Hot-dipped galvanized, ASTM A153/A153M.
f. Prefabricated corner and tee sections with minimum length of 30 inches from point of intersection.
2. Single wythe wall joint reinforcing: Ladder design.
3. Composite wall joint reinforcing: Ladder design with double side rod.
4. Cavity wall joint reinforcing with masonry back-up:
a. Ladder design horizontal joint reinforcing.
b. Wire eyes welded to horizontal joint reinforcing.
1) Length as necessary to project through rigid insulation into airspace.
c. 3/16 inches diameter adjustable pintle veneer anchors.
1) Length as necessary to provide minimum 2 inches embed into veneer mortar joint.
d. Hohmann & Barnard "270 Ladder."

G. Grout Screen:
1. Polypropylene monofilament.

2. 1/4 x 1/4 inches mesh.
3. Width of grout screen to be 2 inches less than nominal width of CMU.

H. Weep Joint Mortar Protection System:

1. 100% recycled polyester.
2. 90% minimum open weave mesh.
3. Minimum 10 inches high by full width of air cavity.
4. Trapezoidal shape.

I. Preformed Rubber Control Joint Inserts:

1. ASTM D2000, M2AA-805.
2. Hardness: ASTM D2240, Shore A Durometer, 80 +/-5.
3. Ultimate elongation: 350%, ASTM D412.
4. Tensile strength: 1000 psi, ASTM D412.
5. Hohmann & Barnard #RS Series.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Thru Wall Flashing and Stainless Steel Drip:

1. Install to provide positive drainage of cavity moisture.
2. Extend stainless steel drip beyond the exterior face of the wall to minimum distance possible while still allowing drip to perform intended purpose.
3. Extend flashing horizontally beyond each edge of lintel or sills to next vertical mortar joint but not less than 4 IN and turn up edge one full veneer course.
    a. Seal all joints.
    b. End dam shall extend up or down to tie into thru wall flashing step.
    c. Seal all joints for continuous watertight barrier.
4. Lap stainless steel drip minimum of 2 inches and bond two pieces together using stainless steel pop rivets and two beads of lap sealant.
5. At metal stud back-up, secure upper edge of flashing with termination bar and sealant.
6. Adhere vertical surface of flashing to back-up wall with adhesive recommended by flashing manufacturer.
7. Extend flashing minimum of 6 inches above top of weep joint mortar protection system.
8. Lap and seal flashing at all inside and outside corners to provide continuous uninterrupted barrier.

C. Weeps:

1. Provide open weep joints at maximum 16 inches on-center in head joint of first course of veneer immediately above thru wall flashing.
    a. Omit mortar bed on top of thru wall flashing at each open weep joint location to allow moisture an unobstructed path to the exterior.
    b. Weep joints shall be not more than 4 inches high.
2. Provide weep vents maximum 16 inches OC in top of head joint of top course of veneer or as indicated on Drawings.
    a. Do not use weep vents in weep joints at the bottom of the wall.
    b. Set weep vents back away from face of veneer slightly so the front edge of the vent is contained within the mortar joint.

D. Weep Joint Mortar Protection System:

1. Install continuous row(s) of material.
2. Provide multiple thicknesses of material compressed as necessary to completely fill the entire air cavity.
    a. Thickness to be at least 10% wider than air cavity being filled.
3. Set material directly on top of thru wall flashing.

E. Butt joints of preformed control joint inserts tightly together and secure with adhesive or sealant acceptable to insert manufacturer.

    a. .

2. Veneer with stud wall back-up: Anchor veneer to back-up using mechanical veneer anchoring system at not more than 16 inches on-center each way.
    a. At all vertical control joints, door openings, window openings, louver openings, etc., provide veneer anchoring system at 16 inches on-center, full height of joint or opening on each side of joint or opening within 8 inches of the joint or perimeter of the opening, regardless of normal system spacing.

F. Reinforcing Masonry:

1. General:
    a. Provide continuous horizontal joint reinforcing in all concrete masonry wall construction.
        1) Embed longitudinal side rods in mortar for entire length with minimum cover of 5/8 inches on exterior side of walls and 1/2 inches at other locations.
            a) For interior partitions, the "exterior" side of the wall is considered the side having the most corrosive atmosphere or the corridor side of the wall.
        2) Lap reinforcement minimum of 12 inches at ends.
            a) Remove cross wires on one side of the lap splice and bend the side rods slightly so the lap is provided with 12 inches of uninterrupted wire lap occurring in the same plane.
        3) Do not bridge control joints with horizontal joint reinforcing.
        4) Do not bridge expansion joints with horizontal joint reinforcing.
        5) At corners and wall intersections use prefabricated "L" and "T" horizontal joint reinforcing sections.
        6) Cut and bend as necessary.
    b. Install reinforcing at 16 inches on-center vertically unless noted otherwise on Drawings.
    c. Install reinforcing 8 inches on-center vertically for a minimum of 24 inches at starter courses.
        1) Do not install horizontal joint reinforcing in veneer mortar joint having through-wall flashing.
    d. In concrete masonry, install horizontal joint reinforcing and adjustable pintle veneer anchors at 8 inches on-center in parapets.
        1) Parapets begin at the course immediately above the top of the roof structural member or top of concrete topping slab on precast roof structure.
    e. In concrete masonry, install additional horizontal joint reinforcing and adjustable pintle veneer anchors 16 inches on-center in courses on each side of vertical control joints and on each jamb of openings for full height of joint or opening.
        1) Alternate with normal wall horizontal joint reinforcing.
        2) Extend reinforcing minimum 32 inches beyond joint or jambs of opening.
2. Repair all galvanized coatings damaged as a result of welding.
    a. See Specification Section 05 50 00 for galvanizing repair system.
3. Reinforcing veneer:
    a. Reinforce veneer with joint reinforcement placed in veneer mortar joints:

1) In new or existing stud wall back-up construction alternate veneer reinforcing with mechanical veneer anchorage system.

G. Install reglets as walls are being constructed.

1. Set reglets true with wall, plumb and at consistent depth.

H. Remove all excess mortar and grout from reglets as walls are being constructed and protect reglet openings from filling with mortar, grout and other construction debris.

END OF SECTION

SECTION 04 05 50
COLD AND HOT WEATHER MASONRY CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold weather protection.
2. Hot weather protection.

B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Brick Industry Association (BIA):
   a. Technical Note 1, Cold and Hot Weather Construction.
2. National Concrete Masonry Association (NCMA).
   a. TEK 3-1C, All Weather Concrete Masonry Construction.
3. The Masonry Society (TMS):
   a. 602, Specification for Masonry Structures.

1.3 DEFINITIONS

A. As defined in TMS 602.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ERECTION AND APPLICATION

A. General:

1. Comply with NCMA TEK 3-1C recommendations and practices.
2. Do not use frozen or ice coated materials.
3. At end of each day or at shutdown, cover tops of all walls not enclosed or sheltered with clear polyethylene minimum 6 mil thick.
   a. Extend down each side of wall minimum of 16 inches and secure.

B. Temporary Facilities:

1. Construct and maintain temporary protection required to permit continuous and orderly progress of work.
2. Provide and maintain heat sufficient to assure temperature above 32 degrees F within protected areas.
3. Remove all temporary facilities after completion of work.

C. Cold Weather Construction and Protection Requirements:

1. Prior to and during installation:
   a. Air temperature 32 to 40 degrees F: Heat mixing water or aggregate to produce mortar temperatures between 40 and 120 degrees F.
   b. Air temperature 25 to 32 degrees F:
      1) Heat mixing water or aggregate to produce mortar temperatures between 40 and 120 degrees F.
      2) Maintain mortar temperatures above freezing until used.

c. Air temperature below 25 degrees F:
    1) Heat mixing water and aggregate to produce mortar temperatures between 40 and 120 degrees F.
    2) Maintain mortar temperatures above freezing until used.
    3) Maintain temperature of units until laid at not less than 40 degrees F.
    4) Provide heat on both sides of walls under construction to maintain air temperature above freezing.
    5) Provide windbreaks or shelters when wind is in excess of 15 mph.
        a) Wind breaks or shelters shall be translucent.

2. After installation:
    a. Air temperature 32 to 40 degrees F: Protect from rain or snow for not less than 24 hours by covering with weather-resistive translucent membrane.
    b. Air temperature 25 to 32 degrees F: Completely cover with translucent weather-resistive membrane for not less than 24 hours.
    c. Air temperature 20 to 25 degrees F: Completely protect with insulating blankets for not less than 24 hours or provide other protection approved by Engineer.
    d. Air temperature below 20 degrees F:
        1) Provide enclosed translucent shelters and heating to maintain air temperature on each side of wall above 32 degrees F for 24 hours.
        2) Do not allow rapid drop in temperature after removal of heat.
    e. Promptly repair all tears, holes, etc., to translucent membrane and shelter using compatible patching material and tape as recommended by membrane manufacturer.

D. Hot Weather Construction and Protection Requirements:
1. Comply with requirements of NCMA, BIA and TMS 602.
2. Storage and preparation of materials.
    a. Cover or shade masonry units and mortar materials from direct sun.
    b. Maintain sand in a damp loose condition.
        1) Sand moisture shall be maintained at minimum 8%.
        2) Sprinkle with cool water as required to maintain moisture content.
    c. Use cool water for mixing mortars.
    d. Avoid using tools and equipment that have been sitting in the sun.
        1) Sprinkle mortar boards, mortar pans, wheel barrows, mixers, etc., with cool water.
    e. Do not wet concrete masonry units prior to use.
3. Installation:
    a. Place masonry units within one minute of the spreading of the mortar.
        1) Mortar beds shall not be spread more than 4 feet ahead of the masonry unit being placed.
    b. Provide wind screens and shading partitions as required to eliminate direct sunlight exposure.
    c. Wet installed units using fog spray of clean water.
    d. Cover installed work immediately after installation to slow rate of loss of moisture from units.
    e. Fog-spray new masonry work until damp.
        1) Repeat fog spraying minimum of three times per day until masonry work has cured for 72 hours.
        2) In high humidity conditions, Engineer reserves the right to discontinue fog spraying if operation is found to be introducing excessive amounts of moisture into the Work.

END OF SECTION

		Standardized abbreviations of all Specifications.
		2022 System-Wide Specification Updates.
		Replaced “MSJC Specification” with “TMS 602” (one that was missed on the below)

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SECTION 04 22 00
CONCRETE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete masonry construction (CMU), including:
   a. Standard concrete masonry.
   b. Pre-colored masonry.
   c. Split-face masonry.
2. Integral water repellent admixture.
3. Masonry special inspection.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 21 00 - Reinforcement.
2. Section 03 31 30 - Concrete, Materials and Proportioning.
3. Section 04 05 13 - Masonry Mortar and Grout.
4. Section 04 05 23 - Masonry Accessories.
5. Section 04 05 50 - Cold and Hot Weather Masonry Construction.
6. Section 07 21 00 - Building Insulation.
7. Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

A. Terminology:

1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
   a. Terminology used in this Section are in accordance with “Standard Unit Nomenclature” Table 1, NCMA TEK 2-3A.

B. Reference Standards:

1. ASTM International (ASTM):
   a. C33, Standard Specification for Concrete Aggregates.
   b. C55, Standard Specification for Concrete Building Brick.
   c. C90, Standard Specification for Loadbearing Concrete Masonry Units.
   d. C140, Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
   e. C426, Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units.
   f. C1357, Standard Test Methods for Evaluating Masonry Bond Strength.
   g. E514, Standard Test Method for Water Penetration and Leakage Through Masonry.
2. National Concrete Masonry Association (NCMA):
   a. TEK 2-3A, Architectural Concrete Masonry Units.
   b. TEK 3-4B, Bracing Concrete Masonry Walls During Construction.
   c. TEK 8-2A, Removal of Stains from Concrete Masonry.
   d. TEK 8-3A, Control and Removal of Efflorescence.
3. The Masonry Society (TMS):
   a. 602, Specification for Masonry Structures.

1.3 QUALITY ASSURANCE:

A. Regulatory Requirements:

1. Applicable construction codes including building code are indicated on drawings.

B. Qualifications:

1. Concrete masonry unit manufacturer shall be licensed or qualified, in writing, by manufacturer of integral water repellent admixture to produce masonry units containing manufacturer's admixture.
    a. Concrete masonry unit manufacturer shall have not less than five years experience manufacturing masonry units containing admixture manufacturer's products.

C. Mockups:

1. Mockups – General: Prior to permanent wall construction, construct mockup.
    a. Construct mockup on a concrete slab as necessary to demonstrate construction details.
        1) Minimum slab thickness: four inches.
    b. Mockup shall show full color range, texture and bond pattern(s) of each type masonry required.
    c. Size: As large as necessary to properly display all conditions required by masonry construction.
        1) Not less than four feet high by eight feet long.
            a) Return corners and intersections not less than four feet.
        2) Mockup shall demonstrate:
            a) Outside corner condition.
            b) Inside corner condition.
            c) Intersection of interior masonry partition.
            d) Jamb condition demonstrating lintel bearing and flashing.
            e) Masonry control joint.
    d. Include all special corners and other special CMU detailing shown on the Drawings.
    e. Include all types of masonry shown on the Drawings, including:
        1) Pre-colored masonry.
        2) Split-face masonry.
    f. Mockup shall include:
        1) Each type of masonry required for the Work.
            a) Each type of special shape.
            b) Each type of back-up wall system(s).
        2) Vertical wall reinforcing with grouted cell.
        3) Typical bond beam construction.
        4) Typical lintel construction.
        5) Positioning, securing and lapping of reinforcing steel.
        6) Masonry accessories:
            a) Horizontal joint reinforcing.
                (1) Positioning and lapping of joint reinforcing.
            b) Veneer anchorage system(s).
            c) Thru wall flashing and drip edge.
                (1) Demonstrate inside and outside corner conditions showing thru wall flashing lapping, jointing and sealing.
            d) Weep joint mortar protection system.
            e) Weep joints and weep vents.

f) Typical control joint construction.
g) Mesh wall ties.
h) Rigid steel masonry anchors.
7) Insulation.
8) Cleaning of masonry work.
2. Step construction of mockup to allow observation of components.
3. Following acceptance of mockup by Engineer, shall constitute minimum standard of quality for the Work.
a. Maintain and safeguard mockup until Substantial Completion.
4. If not acceptable as determined by Engineer, provide additional mockups as necessary.
5. Remove mockups when directed by Engineer.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
a. Scaled (minimum 1/8 inches per foot) plans showing proposed locations of masonry control joints.
b. Wall elevations and sections, indicating special shapes, shape part numbers, applicable dimensions.
c. Detail drawings for:
1) Precast concrete lintels.
a) Show profiles, cross-sections, reinforcement and steel components.
2. Product Data:
a. Manufacturer's information on aggregate and cement type used in manufacture.
b. Data sheet on each type of masonry unit required, including:
1) Pre-colored masonry.
2) Split-face masonry.
c. Data sheets on integral water repellent admixture being used in masonry unit manufacturing.
d. Technical bulletins on cleaning masonry containing integral water repellent.
3. Samples:
a. Concrete Masonry Finish Samples: Manufacturer's complete offering of colors and textures for each type of masonry required.
1) Not less than three inches by three inches Samples for initial selection by Engineer, in consultation with Owner.
2) Submit two, Samples, each eight inches by eight inches, of each type of masonry selected, for final approval by Engineer, in consultation with Owner.
3) Samples of standard gray-colored masonry are not required.

B. Informational Submittals: Submit the following:

1. Certifications:
a. Certification that concrete masonry units meet or exceed requirements of standards referenced.
b. Certification that fire-resistive rated units meet the requirements of applicable building code.
c. Certification that integral water repellent admixture will not affect the use of coloring processes or alter actual colors of factory colored masonry units.
d. Certification of integral water repellent admixture dosage rates from concrete masonry unit Supplier.

e. Concrete masonry Supplier shall certify that integral liquid water repellent admixture was furnished at dosage rate recommended by admixture manufacturer for use in exterior (outdoor) wall construction.

2. Supplier Instructions:
   a. Instructions for handling, storing, and installation.
3. Source Quality Control Submittals:
   a. Results of tests, inspections, and other quality control activities required by the Contract Documents and performed at the place of production or fabrication.
4. Field Quality Control Submittals:
   a. Results of tests, inspections, and other quality control activities required by the Contract Documents and performed at the Site.
5. Qualifications:
   a. Supplier of masonry units when requested by Engineer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Comply with Section 01 65 50 - Product Delivery, Storage, and Handling Requirements.
   2. Inspect units upon delivery, to verify color match with approved samples, dimensional quality, and trueness of unit.

B. Storage and Handling Requirements:
   1. Materials and equipment may be stored outdoors on supports and completely covered with covering impervious to water:
   2. Covering material shall be weather-proof but vapor permeable to prevent accumulation of moisture under cover.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Standard masonry units:
      a. Any manufacturer capable of meeting the requirements of this Specification Section.
   2. Integral water repellent admixture:
      a. GCP Applied Technologies, Inc.
      b. ACM Chemistries, Inc.

2.2 MATERIALS

A. Cement: Type I or II Portland, ASTM C150.

B. Aggregate: ASTM C33.

C. Reinforcing Bars: Refer to Section 03 21 00.

D. Mortar: Refer to Section 04 05 13.

E. Masonry Grout: Refer to Section 04 05 13.

F. Masonry Accessories: Refer to Section 04 05 23.

G. Insulation: Refer to Section 07 21 00.

H. Sealants: Refer to Section 07 92 00.

I. Integral Concrete Masonry Water Repellent:
   1. Liquid polymeric admixture.

2. GCP Applied Technologies, Inc., "DRY-BLOCK".

2.3 MANUFACTURED UNITS

A. General:

1. Masonry units of each type, color, or face style shall be from a single production run by Supplier.
2. Factory fabricate special shapes unless otherwise required.
3. Fire resistive units: Fabricate to comply with applicable building code.
4. Fabricated in manufacturing facility.
5. Provide square corners unless required otherwise.

B. Concrete Masonry Units:

1. Modular units: ASTM C90.
   a. Normal weight units: Minimum of 125 pound/cubic foot.
   b. Light weight or medium weight units are not acceptable.
   c. Where indicated on the Drawings.
   d. Color:
      1) Interior units: Standard Gray
2. Manufactured Stone Masonry:
   a. Basis-of-Design: Renaissance Masonry Units by Arriscraft (Georgia); calcium silicate masonry units, ASTM C73, Grade SW; pressure formed and autoclaved solid units.
      1) 3-5/8 inch deep x 7-5/8 inch high x 23-5/8 inch long.
      2) Texture: Satin.
      3) Color: to be selected by architect from standard offerings..
3. Design compressive strength: f'm=1,500 PSI minimum.
   a. Determine in accordance with TMS 602.
      1) Unit strength method, sampled and tested in accordance with ASTM C140.
4. Provide masonry units manufactured with integral water repellent admixture for the following exposures:
   a. Exterior veneer.
   b. Exterior single-wythe construction.
   c. Exterior composite wall construction.
   d. Interior areas defined as wet and/or corrosive.
      1) See Specification Section 07 92 00 for definition of wet and/or corrosive areas.
5. Special shapes and faces:
   a. Corner units.
      1) Corner units used in veneer wythe shall have a finished return leg one-half the length of a standard modular stretcher unit.
      2) Corner units shall maintain regular modular masonry coursing.
   b. Finished end units.
   c. Other special shapes as indicated on Drawings or necessary to maintain coursing.

C. Cast Stone:

1. Fabricate in the manufacturing plant.
2. Cast Stone to meet or exceed ASTM C1364.
   a. Compressive Strength: ASTM C 1194.
      1) 6,500 psi minimum.
   b. Absorption: ASTM C 1195.

1) 6% maximum by the cold water method.
2) 10% maximum by the boiling method.

c. Air Content: ASTM C173 or C 231.
1) Wet cast product: 4 - 8% for units exposed to freeze-thaw environments.

d. Freeze-thaw: ASTM C1364.
1) CPWL less than 5% after 300 cycles of freezing and thawing.

e. Linear Shrinkage: ASTM C 426.
1) 0.065% maximum.

3. Fabricate sizes and profiles indicated on Drawings.
4. Curing:
a. Cure units in a warm curing chamber approximately 100 degrees F at 95% relative humidity for approximately 12 hours, or cure in a 95% moist environment at a minimum 70 degrees F for 16 hours after casting.
b. Additional yard curing at 95% relative humidity shall be 350 degree-days (i.e. 7 days @ 50 degrees F or 5 days @ 70 degrees F) prior to shipping.
1) Form cured units shall be protected from moisture evaporation with curing blankets or curing compounds after casting.

2.4 PERFORMANCE AND DESIGN REQUIREMENTS:

A. Integral Concrete Masonry Water Repellent:

1. Water permeance of masonry: Capable of achieving a Class E Rating when evaluated using ASTM E514 with the test extended to 72 hours, using the rating criteria specified in ASTM E514.
2. Flexural bond strength of masonry: An increase of 10%, minimum, in masonry flexural bond strength shall occur as a result of adding integral water-repellent concrete masonry and mortar admixtures when compared to a control (containing no admixtures) concrete masonry and mortar tested in accordance with ASTM C1357.
3. Compressive strength validation shall be per unit strength method.
4. Drying shrinkage of masonry: Maximum 5% increase in drying shrinkage of the concrete masonry units shall occur as a result of adding integral water repellent concrete masonry admixture when compared to a control (containing no admixtures) concrete masonry when tested in accordance with ASTM C426.
5. Grout shear bond strength: Maximum 5% decrease in grout shear bond strength shall occur as a result of adding integral water repellent admixture to the concrete masonry units when compared to a control (containing no admixtures).

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify that anchors and flashings are correct.

B. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.

1. Properly locate openings, movement type joints, returns, and offsets weep joints and weep vents.

3.2 INSTALLATION

A. General:

1. Build in flashing, reinforcing, reglets, weeps, weep vents and related accessory items.
a. See Specification Section 04 05 23 for installation of accessory items.
2. Perform all cutting using masonry saw blades.
3. Drill holes using masonry drill bits or core drill.

a. Holes made by chipping unit will not be accepted.

4. Install field units in running bond, unless noted otherwise.
   a. Provide special coursing where indicated on the Drawings.
5. Cut as required to maintain bond pattern.
6. Use solid units where cutting or laying would expose holes and as noted on Drawings.
7. Avoid use of less than half size units, whenever possible.
8. Do not use chipped, cracked, spalled, stained or imperfect units exposed in finish work.
9. Provide units of uniform color, within the range demonstrated on the approved mock-up.
10. Do not wet concrete masonry units.
11. Build chases and recesses as indicated and required for work of other trades.
    a. Provide not less than 8 inches of masonry between chase or recess and jamb of openings, and between adjacent chases and recesses unless detailed otherwise on the Drawings.

B. Concrete Masonry Units:

1. Grout solid all cells containing steel reinforcing and as indicated on Drawings.
   a. Refer to Specification Section 04 05 13 for grouting.

C. Laying and Tooling:

1. Lay masonry units with completely filled bed and head joints.
   a. Provide full mortar bed on all block cross webs and completely fill head joints.
      1) Do not slush head joints.
      2) Protect cells requiring grout fill from mortar droppings.
      3) Omit mortar from head joint at weep joint opening.
   b. In cavity wall construction, taper mortar on inside edge of veneer and outside edge of masonry back-up to prevent mortar from falling into cavity.
   c. Protect cavity during laying of masonry as required to prevent mortar droppings from filling cavity.
   d. Install weep joint mortar protection system in cavity per Specification Section 04 05 23.
2. Maintain nominal 3/8 inches joint widths.
   a. Cut joints flush where concealed.
   b. Tool exposed joints concave.
   c. Compress mortar in below ground joints and in joints concealed by insulation in cavity wall construction.
   d. Provide wider joints where noted on Drawings.
      1) In no case shall any mortar joint be more than 3/4 inches wide.
   e. Where masonry sits on top of steel support omit the mortar joint on top of the support and sit masonry directly on top of the thru wall flashing or the steel support member unless a mortar joint is required to maintain coursing.
3. During tooling of joints, enlarge any voids or holes except weeps, and completely fill with mortar.
4. Point-up all joints at corners, openings, and adjacent work to provide neat, uniform appearance.
5. Remove masonry disturbed after laying.
   a. Clean and relay in fresh mortar.
   b. Do not pound units to fit.
   c. If adjustments are required, remove units, clean, and reset in fresh mortar.
6. Where work is stopped and later resumed, rack back 1/2 masonry unit length in each course.

a. Remove loose units and mortar prior to laying fresh masonry.

7. As work progresses, build in items indicated on Drawings and specified.
   a. Fill in solidly with mortar around built-in items.
   b. Where built-in items are to be embedded in cores of hollow masonry units, place grout screen in joint below and fill core solid with mortar.
8. In composite wall construction, fill all collar joints solid with grout unless noted otherwise on the Drawings.
   a. Ensure that grout in collar joint is free of air pockets and voids.
   b. Do not allow grout in collar joint to bridge control joint.

D. Cast Stone:

1. Comply with Cast Stone Institute Technical Manual.
2. Setting:
   a. Drench units with clean water prior to setting.
   b. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.
   c. Set units in full bed of mortar, unless otherwise detailed.
      1) Set stones 1/8 inches or less, within the plane of adjacent units.
3. Joints:
   a. Size: 3/8 inches.
   b. Tolerance: Plus 1/16 inches, minus 1/8 inches.
   c. Mortar: ASTM C 270, Type N.
      1) Use a full bed of mortar at all bed joints.
      2) Flush vertical joints full with mortar.
   d. Leave all joints with exposed tops, head joints in copings and joints in projecting components open for sealant.
      1) See Specification Section 07 92 00 for backer rod and sealant.
   e. Locate joints in accordance with approved Shop Drawings.
      1) Modifications to joint size or location not allowed without written consent of the Engineer.
   f. Rake mortar joints 3/4 inches for pointing.
   g. Remove excess mortar from unit faces immediately after setting.
   h. Tuck point unit joints to a slight concave profile.

E. Control Joints and Sealants:

1. Provide vertical expansion, control and isolation joints where indicated on Drawings.
2. Where not indicated on Drawings, submit proposed control joint locations in accordance with the following requirements:
   a. Provide control joints at maximum 24 feet OC.
   b. Provide at all T intersections.
   c. Locate joints so as to allow lintels and bond beams above and below openings to extend beyond the opening as indicated on the Drawings without control joints thru the lintel or bond beam.
3. Rake out mortar in joint.
4. Refer to Specification Section 07 92 00 for sealant installation requirements.
   a. Seal control and expansion joints.

F. Tolerances:

1. Maximum variation from plumb in vertical lines and surfaces of columns, walls, and arises:
   a. 1/4 inches in 10 feet.

b. 3/8 inches in a story height not to exceed 20 feet.
c. 1/2 inches in 40 feet or more.

2. Maximum variation from plumb for external corners, expansion joints, and other conspicuous lines:
   a. 1/4 inches in any story or 20 feet maximum.
   b. 1/2 inches in 40 feet or more.
3. Maximum variation from level of grades for exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines:
   a. 1/4 inches in any bay or 20 feet.
   b. 1/2 inches in 40 feet or more.
4. Maximum variation from plan location of related portions of columns, walls, and partitions:
   a. 1/2 inches in any bay or 20 feet.
   b. 3/4 inches in 40 feet or more.
5. Maximum variation in cross-sectional dimensions of columns and thicknesses of walls from dimensions shown on Drawings:
   a. Minus 1/4 inches.
   b. Plus 1/2 inches.
6. Maximum variation in mortar joint width:
   a. Bed joints: 3/32 inches in 10 feet.
   b. Head joints:
      1) Minus 1/8 inches.
      2) Plus 1/8 inches.

G. Protect against weather when work is not in progress.
   1. During inclement weather conditions, cover top of walls with translucent waterproof membrane.
   2. See Specification Section 04 05 50.

H. Protect against cold/hot weather as specified in Specification Section 04 05 50.

3.3 CLEANING

A. Clean concrete masonry as the wall is being constructed using fiber brushes, wooden paddles and scrapers.
   1. Do not use metal tools or wire brushes.
   2. No acid-based cleaning solutions shall be used unless approved in writing by Engineer.

B. Remove dirt and stains in accordance NCMA TEK 8-2A.

C. Remove primary efflorescence in accordance with NCMA TEK 8-3A.

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DIVISION 05

METALS

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SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Custom fabricated metal items and certain manufactured units not otherwise indicated to be supplied under work of other Specification Sections.
2. Design of all temporary bracing not indicated on Drawings.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 15 19 - Anchorage to Concrete.
2. Section 03 31 30 - Concrete, Materials and Proportioning.
3. Section 05 52 23 - Steel Railings.
4. Section 09 91 10 - Architectural Painting.

1.2 REFERENCES

A. Definitions

1. Fasteners: As defined in ASTM F1789.
2. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 oz of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.
3. Hardware: As defined in ASTM A153/A153M.
4. Installer or Applicator:
   a. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
   b. Installer and applicator are synonymous.
5. PQR: Procedure Qualification Record
6. MIC: Microbiologically induced corrosion.

B. Referenced Standards: Standards referenced in this section include, but are not necessarily limited to, the following:

1. Aluminum Association (AA):
   a. ADM 1, Aluminum Design Manual.
2. American Association of State Highway and Transportation Officials (AASHTO):
   a. HB, Standard Specifications for Highway Bridges.
3. American Institute of Steel Construction (AISC):
   a. 325, Manual of Steel Construction.
   b. 360, Specifications for Structural Steel Buildings (referred to herein as AISC Specification).
4. The American Ladder Institute (ALI):
   a. A14.3, Ladders - Fixed - Safety Requirements.
5. American Society of Civil Engineers (ASCE):
   a. 7, Minimum Design Loads for Buildings and Other Structures.
6. ASTM International (ASTM):
   a. A6, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
   b. A36, Standard Specification for Carbon Structural Steel.

c. A47, Standard Specification for Ferritic Malleable Iron Castings.
d. A48, Standard Specification for Gray Iron Castings.
e. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
f. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold Finished.
g. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
h. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
i. A197, Standard Specification for Cupola Malleable Iron.
j. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
k. A276, Standard Specification for Stainless Steel Bars and Shapes.
l. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
m. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
n. A380/A380M, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
o. A500, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
p. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
q. A536, Standard Specification for Ductile Iron Castings.
r. A554, Standard Specification for Welded Stainless Steel Mechanical Tubing.
s. A572, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
t. A563, Standard Specification for Carbon and Alloy Steel Nuts.
u. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
v. A668, Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use.
w. A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
x. A786, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
y. A992, Standard Specification for Steel for Structural Shapes.
z. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
aa. A1011, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
bb. B26, Standard Specification for Aluminum-Alloy Sand Castings.
cc. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
dd. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
ee. B308, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
ff. B429, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
gg. B632, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
hh. F436, Standard Specification for Hardened Steel Washers Inch and Metric Dimensions.

ii. F467, Standard Specification for Nonferrous Nuts for General Use.

jj. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.

kk. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

ll. F835, Standard Specification for Alloy Steel Socket Button and Flat Countersunk Head Cap Screws.

mm. F1789, Standard Terminology for F16 Mechanical Fasteners.

nn. F3125, Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

7. American Welding Society (AWS):
   a. A5.1/A5.1M, Specification for Carbon Steel Electrodes for Shielded Metal Arc Welding.
   b. D1.1, Structural Welding Code - Steel.
   c. D1.2, Structural Welding Code - Aluminum.
   d. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
8. National Association of Architectural Metal Manufacturers (NAAMM):
   a. AMP 510, Metal Stairs Manual.
   b. AMP 555, Code of Standard Practice for the Architectural Metal Industry (Including Miscellaneous Iron).
   c. MBG 531, Metal Bar Grating Manual.
9. NACE International (NACE).
10. Nickel Development Institute (NiDI):
    a. Publication 11 007, Guidelines for the Welded Fabrication of Nickel-Containing Stainless Steels for Corrosion Resistant Services.
11. Occupational Safety and Health Administration (OSHA):
    a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
2. Fabrication and/or layout drawings and details:
   a. Submit drawings for all fabrications and assemblies.
      1) Include erection drawings, plans, sections, details and connection details.
   b. Identify materials of construction, shop coatings and third party accessories.
3. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Provide manufacturer's standard allowable load tables for the following:
      1) Grating and checkered plate.
      2) Castings, trench covers and accessories.
      3) Modular framing systems.
4. Contractor designed systems and components:
   a. Certification that manufactured units meet all design loads specified.
   b. Shop Drawings and engineering design calculations:
      1) Indicate design live loads.
      2) Sealed by a licensed professional engineer, registered in the State of Iowa.
      3) Engineer will review for general compliance with Contract Documents.

B. Informational Submittals:

1. Certification of welders and welding processes.
    a. Indicate compliance with AWS.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Qualify welding procedures and welding operators in accordance with AWS.
    a. All welders shall be qualified in all positions that will be utilized during welding. Welders shall utilize qualified PQR for testing.
2. Fabricator shall have minimum of 10 years of experience in fabrication of metal items specified.
3. Engineer for contractor-designed systems and components: Professional structural engineer licensed in the State of Iowa.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and handle fabrications to avoid damage.

B. Store above ground on skids or other supports to keep items free of dirt and other foreign debris and to protect against corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Abrasive stair nosings (embedded in concrete stairs):
    a. American Safety Tread.
    b. Balco.
2. Headed studs and deformed bar anchors:
    a. Nelson Stud Welding Div., TRW Inc.
    b. Stud Welding Products, Inc.
3. Mechanical anchor bolts:
    a. See Section 03 15 19.
4. Epoxy adhesive anchor bolts:
    a. See Section 03 15 19.
5. Concrete screw anchors:
    a. See Section 03 15 19.
6. Castings, trench covers and accessories:
    a. Neenah Foundry Co.
    b. Deeter Foundry Co.
    c. Barry Craft Construction Casting Co.
    d. McKinley Iron Works.
7. Galvanizing repair paint:
    a. Clearco Products Co., Inc.
    b. ZRC Products.
8. Modular framing system:
    a. Unistrut Building Systems.
    b. B-Line Systems.
    c. Kindorf.

2.2 MATERIALS

A. Steel:

1. Structural:
   a. W-shapes and WT-shapes: ASTM A992, Grade 50.
   b. All other plates and rolled sections: ASTM A36.
2. Pipe: ASTM A53, Types E or S, Grade B or ASTM A501.
3. Structural tubing:
   a. ASTM A500, Grade B (46 ksi minimum yield).
4. Bolts, high strength:
   a. ASTM F3125, Grade A325.
5. Nuts, high strength:
   a. ASTM A563.
6. Washers (hardened):
   a. ASTM F436.
   b. Provide two (2) washers with all bolts.
7. Bolts and nuts (unfinished):
   a. ASTM A307, Grade A.
8. Welding electrodes: AWS D1.1, E70 Series.
9. Steel forgings: ASTM A668.

B. Iron:

1. Ductile iron: ASTM A536.
2. Gray cast iron: ASTM A48 (minimum 30,000 psi tensile strength).
3. Malleable iron: ASTM A47, ASTM A197.

C. Stainless Steel:

1. Stainless steel in welded applications: Low carbon 'L' type.
2. Minimum yield strength of 30,000 psi and minimum tensile strength of 75,000 psi.
   a. Bars, shapes: ASTM A276, Type 304.
   b. Tubing and pipe: ASTM A269, ASTM A312 or ASTM A554, Type 304 or 316.
   c. Strip, plate and flat bars: ASTM A666, Type 304 or 316.
   d. Bolts and nuts: ASTM F593, Type 304 or 316.
3. Minimum yield strength of 25,000 psi and minimum tensile strength of 70,000 psi.
   a. Strip, plate and flat bar for welded connections, ASTM A666, Type 304L or 316L.
4. Welding electrodes: In accordance with AWS for metal alloy being welded.

D. Aluminum:

1. Alloy 6061-T6, 32,000 psi tensile yield strength minimum.
   a. ASTM B221 and ASTM B308 for shapes including beams, channels, angles, tees and zees.
   b. Weir plates, baffles and deflector plates, ASTM B209.
2. Alloy 6063-T5 or T6, 15,000 psi tensile yield strength minimum.
   a. ASTM B221 and ASTM B429 for bars, rods, wires, pipes and tubes.
3. ASTM B26 for castings.
4. ASTM F468, alloy 2024 T4 for bolts.
5. ASTM F467, alloy 2024 T4 for nuts.
6. Electrodes for welding aluminum: AWS D1.2, filler alloy 4043 or 5356.

E. Washers: Same material and alloy as found in accompanying bolts and nuts.

F. Embedded Anchor Bolts:

1. See Specification Section 03 15 19.

G. Mechanical Anchor Bolts and Adhesive Anchor Bolts:

1. See Specification Section 03 15 19.

H. Headed Studs: ASTM A108 with a minimum yield strength of 50,000 psi and a minimum tensile strength of 60,000 psi.

I. Deformed Bar Anchors: ASTM A1064 with a minimum yield strength of 70,000 psi and a minimum tensile strength of 80,000 psi.

J. Iron and Steel Hardware: Galvanized in accordance with ASTM A153/A153M when required to be galvanized.

K. Galvanizing Repair Paint:

1. High zinc dust content paint for regalvanizing welds and abrasions.
2. ASTM A780.
3. Zinc content: Minimum 92% in dry film.
4. ZRC "ZRC Cold Galvanizing" or Clearco "High Performance Zinc Spray."

L. Dissimilar Materials Protection: See Specification Section 09 96 00.

2.3 MANUFACTURED UNITS

1. Rails:

B. Bollards:

1. 8 inches diameter extra strength steel pipe, ASTM A53.
   a. Galvanized.
   b. See Specification Section 09 91 10 for painting requirements.

C. Loose Lintels:

1. Steel, ASTM A36 or ASTM A572 Grade 50, sizes as indicated on Drawings.
2. Hot-dip galvanized per ASTM A123/A123M.

D. Modular Framing System:

1. Materials:
   a. Steel: ASTM A1011, carbon steel, Grade 33.
      1) Hot-dipped galvanized, ASTM A123 or ASTM A153.
   b. Aluminum: ASTM B221 or ASTM B209.
   c. Stainless steel: ASTM A666.
2. Channels and inserts:
   a. Steel or stainless steel: Minimum 12 GA.
   b. Aluminum: Minimum 0.080 inches.
   c. Channels to have one side with a continuous slot with in-turned lips.
      1) Width: 1-5/8 inches.
      2) Depth and configuration as necessary for loading conditions.
3. Fittings: Same material as system major components.
4. Fasteners:
   a. Nuts: Toothed groves in top of nuts to engage the in-turned lips of channel.
   b. Bolts: Hex-head cap screws.
   c. Same material as system major components.

5. End caps:
    a. At each exposed end of each piece mounted on walls, or guardrails, or suspended from framing 7 feet or less above the floor or platform.
        a) Plastic for all exposed ends 7 feet or more above floor or platform.
        b) Plastic or metallic for all other exposed ends.
6. Provide dissimilar materials protection in accordance with Specification Section 09 91 10.
7. Repair all cut ends or otherwise damaged areas of galvanized steel in accordance with ASTM A780.

2.4 FABRICATION

A. Verify field conditions and dimensions prior to fabrication.

B. Form materials to shapes indicated with straight lines, true angles, and smooth curves.

1. Grind smooth all rough welds and sharp edges.
    a. Round all corners to approximately 1/32 - 1/16 inches nominal radius.

C. Provide drilled or punched holes with smooth edges.

1. Punch or drill for field connections and for attachment of work by other trades.

D. Weld Shop Connections:

1. Stainless steel connections subject to corrosive environments or immersion service will be subject to the following enhanced visual and welding requirements:
    a. Fabricator
        1) Fabricator shall have QC program and procedures in place to avoid cross contamination with carbon steel products and material.
    b. Weld Procedures
        1) Weld procedures shall be qualified for all positions that will be welded, qualified by testing in accordance with applicable welding code AWS D1.6 requirements.
        2) Procedure Qualification Record (PQR) shall document all essential variables to perform consistent quality welds. PQR shall include maximum heat input per pass and shall be tested for CVN properties, macro hardness, G48 mass loss ferric chloride pitting corrosion test, and macro/micro hardness testing.
2. Welds shall be continuous fillet type unless indicated otherwise.
3. Full penetration butt weld at bends in stair stringers and ladder side rails.
4. Weld structural steel in accordance with AWS D1.1 using Series E70 electrodes conforming to AWS A5.1/A5.1M.
5. Weld aluminum in accordance with AWS D1.2.
6. All headed studs to be welded using automatically timed stud welding equipment.
7. Grind smooth welds that will be exposed.

A. Make provisions to prevent carbon steel/free iron contamination of stainless steel surfaces (i.e., contact between carbon steel or iron and stainless steel component). Do not use cutting/grinding/drilling tools, wire brushes, or wire wheels on stainless steel that have been previously used on carbon steel or iron. Do not support or hang stainless steel weldments or fixtures with carbon steel cables or dunnage.

B. Passivate stainless steel items and stainless steel welds after they have been ground smooth. In accordance with ASTM A380/A380M.

C. Passivation Requirements:

1. For components/assemblies to be used only in dry air service environments:
    a. No post-fabrication passivation treatments are required for external corrosion control.

D. Conceal fastenings where practicable.

E. Fabricate work in shop in as large assemblies as is practicable.

F. Tolerances:

1. Rolling:
    a. ASTM A6.
    b. When material received from the mill does not satisfy ASTM A6 tolerances for camber, profile, flatness, or sweep, the Contractor is permitted to perform corrective work by the use of controlled heating and mechanical straightening, subject to the limitations of the AISC Specification.
2. Fabrication tolerance:
    a. Member length:
        1) Both ends finished for contact bearing: 1/32 inches.
        2) Framed members:
            a) 30 feet or less: 1/16 inches.
            b) Over 30 feet: 1/8 inches.
    b. Member straightness:
        1) Compression members: 1/1000 of axial length between points laterally supported.
        2) Non-compression members: ASTM A6 tolerance for wide flange shapes.
    c. Specified member camber (except compression members):
        1) 50 feet or less: -0/+1/2 inches.
        2) Over 50 feet: -0/+1/2 inches (+1/8 inches per 10 feet over 50 feet).
        3) Members received from mill with 75% of specified camber require no further cambering.
        4) Beams/trusses without specified camber shall be fabricated so after erection, camber is upward.
        5) Camber shall be measured in fabrication shop in unstressed condition.
    d. At bolted splices, depth deviation shall be taken up by filler plates.
        1) At welded joints, adjust weld profile to conform to variation in depth.
        2) Slope weld surface per AWS requirements.
    e. Finished members shall be free from twists, bends and open joints.
        1) Sharp kinks, bends and deviation from above tolerances are cause for rejection of material.

G. Fabricate grating, ladders and accessories using galvanized steel unless shown otherwise on Drawings.

1. Finish:
    a. Mill, unless noted otherwise.
    b. Coat surfaces in contact with dissimilar materials.
        1) See Specification Section 09 91 10.

H. Fabricate grating in accordance with NAAMM MBG 531.

1. Maximum tolerance for difference in depth between grating depth and seat or support angle depth: 1/8 inches.
2. Distance between edge of grating and face of embedded seat angle or face of wall or other structural member: 1/4 inches.
    a. Tolerance: NAAMM MBG 531.
3. Removable sections: Not wider than 3 feet and not heavier than 100 pounds.
4. Ends and perimeter edges: Banded, with alternate bearing bars welded to band.
    a. Provide full depth banding unless noted otherwise.

b. Banding at trenches and sumps to be 1/4 inches less than grating depth to allow for drainage.

5. Openings through grating: Reinforced to provide required load carrying capacity and banded with 4 inches high toe plate.
6. Provide joints at openings between individual grating sections.
7. Fabricate grating so that bearing bars and cross bars in adjacent sections are aligned.

I. See Specification Section 09 96 00 for preparation and painting of ferrous metals and other surfaces.

2.5 SOURCE QUALITY CONTROL

A. Surface Preparation:

1. Refer to Specification Section 09 91 10 for surface preparation requirements.

B. Shop Inspection and Testing:

1. Employ and pay for the services of a qualified independent testing agency to inspect and test all structural steel work for compliance with Contract Documents.
2. Contractor responsible for testing to qualify shop and field welders and as needed for Contractor's own quality control to ensure compliance with Contract Documents.
3. Independent testing agency shall have a minimum of five years performing similar work and shall be subject to Owner's approval.

C. Responsibilities of Testing Agency:

1. Inspect shop and field welding in accordance with AWS Code including the following non-destructive testing:
   a. Visually inspect all welds.
   b. In addition to visual inspection, test 50% of full penetration welds and 20% of fillet welds with liquid dye penetrant or mag particle.
   c. Test 20% of liquid dye penetrant tested full penetration welds with ultrasonic or radiographic testing.
   d. For all surfaces intended to be immersed or intended to be water tight:
      1) 100% of all fillet welds shall be PT tested to ensure water-tight surfaces are free of surface defects that would create areas for MIC.
      2) 100% of all completed SS welds and material shall be passivated in accordance with ASTM A380/A380M.
2. Inspect high-strength bolting in accordance with the RCSC Specification for Structural Joints Using High-Strength Bolts, Section 9.
   a. Verify direct tension indicator gaps, if applicable.
3. Inspect structural steel which has been erected.
4. Inspect stud welding in accordance with AWS Code.
5. Prepare and submit inspection and test reports to Engineer.
   a. Assist Engineer to determine corrective measures necessary for defective work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction in time to allow their installation.

1. If such items are not provided in time for installation, cut in and install.

B. Prior to installation, inspect and verify condition of substrate.

C. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

1. Field welding aluminum is not permitted unless approved in writing by Engineer.

3.2 INSTALLATION

A. Set metal work level, true to line, plumb.

1. Shim and grout as necessary.

B. Contractor is solely responsible for safety.

1. Construction means and methods and sequencing of work is the prerogative of the Contractor.
2. Take into consideration that full structural capacity of many structural members is not realized until structural assembly is complete; e.g., until slabs, decks, and diagonal bracing or rigid connections are installed.
3. Partially complete structural members shall not be loaded without an investigation by the Contractor.
4. Until all elements of the permanent structure and lateral bracing system are complete, temporary bracing for the partially complete structure will be required.

C. Adequate temporary bracing to provide safety, stability and to resist all loads to which the partially complete structure may be subjected, including construction activities and operation of equipment is the responsibility of the Contractor.

1. Plumb, align, and set structural steel members to specified tolerances.
2. Use temporary guys, braces, shoring, connections, etc., necessary to maintain the structural framing plumb and in proper alignment until permanent connections are made, the succeeding work is in place, and temporary work is no longer necessary.
3. Use temporary guys, bracing, shoring, and other work to prevent injury or damage to adjacent work or construction from stresses due to erection procedures and operation of erection equipment, construction loads, and wind.
4. Contractor shall be responsible for the design of the temporary bracing system and must consider the sequence and schedule of placement of such elements and effects of loads imposed on the structural steel members by partially or completely installed work, including work of all other trades.
    a. If not obvious from experience or from the Drawings, confer with the Engineer to identify those structural steel elements that must be complete before the temporary bracing system is removed.
5. Remove and dispose of all temporary work and facilities off-site.

D. Examine work-in-place on which specified work is in any way dependent to ensure that conditions are satisfactory for the installation of the work.

1. Report defects in work-in-place which may influence satisfactory completion of the work.
2. Absence of such notification will be construed as acceptance of work-in-place.

E. Field Measurement:

1. Take field measurements as necessary to verify or supplement dimensions indicated on the Drawings.
2. Contractor responsible for the accurate fit of the work.

F. Check the elevations of all finished footings or foundations and the location and alignment of all anchor bolts before starting erection.

1. Use surveyor's level.
2. Notify Engineer of any errors or deviations found by such checking.

G. Framing member location tolerances after erection shall not exceed the frame tolerances listed in the FIELD QUALITY CONTROL Article in PART 3 of this Specification Section.

H. Erect plumb and level; introduce temporary bracing required to support erection loads.

I. Use light drifting necessary to draw holes together.

1. Drifting to match unfair holes is not allowed.

J. Welding:

1. Comply with AWS D1.1, AWS D1.2, and AWS D1.6 (as applicable for the material welded) and requirements of this Section's "Fabrications" Article in "Part 2 - Products".
2. When joining two sections of steel of different ASTM designations, welding techniques shall be in accordance with a qualified AWS D1.1 procedure.
3. 100% of all completed stainless steel welds and material shall be passivated in accordance with ASTM A380/A380M.

K. Shore existing members when unbolting of common connections is required.

1. Use new bolts for rebolting connections.

L. Clean stored material of all foreign matter accumulated prior to the completion of erection.

M. Bolt Field Connections: Where practicable, conceal fastenings.

N. Field Welding:

1. Follow AWS procedures.
2. Grind welds smooth where field welding is required.
3. 100% of all completed stainless steel welds and material shall be passivated in accordance with ASTM A380/A380M.

O. Field cutting grating or checkered plate to correct fabrication errors is not acceptable.

1. Replace entire section.

P. Remove all burrs and radius all sharp edges and corners of miscellaneous plates, angles, framing system elements, etc.

Q. Unless noted or specified otherwise:

1. Connect steel members to steel members with 3/4 inches diameter ASTM F3125, Grade A325 high strength bolts.
2. Connect aluminum to aluminum with 3/4 inches diameter stainless bolts.
3. Connect aluminum to structural steel using 3/4 inches diameter stainless steel bolts.
    a. Provide dissimilar metals protection.
4. Connect aluminum and steel members to concrete and masonry using stainless steel mechanical anchor bolts or adhesive anchor bolts unless shown otherwise.
    a. Provide dissimilar materials protection.
5. Provide washers for all bolted connections.
6. Where exposed, bolts shall extend a maximum of 3/4 inches and a minimum of 1/2 inches above the top of installed nut.
    a. If bolts are cut off to required maximum height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nuts.

R. Install and tighten ASTM F3125, Grade A325 high-strength bolts in accordance with the AISC 325, Allowable Stress Design (ASD).

1. Provide hardened washers for all Grade A325 bolts.
    a. Provide the hardened washer under the element (nut or bolt head) turned in tightening.

S. After bolts are tightened, upset threads of ASTM A307 bolts or anchor bolts to prevent nuts from backing off.

T. Secure metal to wood with lag screws of adequate size with appropriate washers.

U. Do not field splice fabricated items unless said items exceed standard shipping length or change of direction requires splicing.

1. Provide full penetration welded splices where continuity is required.

V. Provide each fabricated item complete with attachment devices as indicated or required to install.

W. Anchor such that work will not be distorted nor fasteners overstressed from expansion and contraction.

X. Set beam and column base plates accurately on nonshrink grout as indicated on Drawings.

1. See Division 03 Specification Sections for non-shrink grout and anchorage.
2. Set and anchor each base plate to proper line and elevation.
    a. Use metal wedges, shims, or setting nuts for leveling and plumbing columns and beams.
        1) Wedges, shims and setting nuts to be of same metal as base plate they support.
        2) Tighten nuts on anchor bolts.
    b. Fill space between bearing surface and bottom of base plate with nonshrink grout.
        1) Fill space until voids are completely filled and base plates are fully bedded on wedges, shims, and grout.
    c. Do not remove wedges or shims.
        1) Where they protrude, cut off flush with edge of base plate.
    d. Fill sleeves around anchor bolts solid with non-shrink grout.

Y. Tie anchor bolts in position to embedded reinforcing steel using wire.

1. Tack welding prohibited.
    a. Coat projecting bolt threads and nuts with heavy coat of clean grease.
2. Anchor bolt location tolerance:
    a. Per Section 03 15 19.

Z. Install bollards as detailed on Drawings.

1. Fill pipe with concrete and round off at top.

AA. Provide abrasive stair nosings in each tread and landing of all concrete stairs and at each concrete stair landing having metal stair structure attaching to the concrete landing.

1. Center stair nosings in stair width.

BB. Accurately locate and place frames for openings before casting into floor slab so top of plate is flush with surface of finished floor.

1. Keep screw holes clean and ready to receive screws.

CC. Attach grating to end and intermediate supports with grating saddle clips and bolts.

1. Maximum spacing: 2 feet on-center with minimum of two per side.
2. Attach individual units of aluminum grating together with clips at 2 feet on-center maximum with a minimum of two clips per side.

DD. Repair damaged galvanized surfaces in accordance with ASTM A780.

1. Prepare damaged surfaces by abrasive blasting or power sanding.
2. Apply galvanizing repair paint to minimum 6 mils DFT in accordance with manufacturer's instructions.

EE. Anchor ladder to concrete structure with minimum 3/4 inches stainless steel anchor bolts with minimum 6 inches embedment.

FF. Anchor ladder to masonry structure with minimum 3/4 inches stainless steel anchor bolts with minimum 6 inches embedment.

1. When anchoring into masonry, fill masonry cores with grout at anchor locations and each masonry core within 8 inches of anchor
2. When anchoring into cavity wall construction, provide minimum 6 inches embedment into concrete or masonry back-up wall.
    a. At each anchor location, provide sleeve between back face of veneer and cavity face of concrete or masonry back-up wall.
    b. Cut cavity insulation as required and seal around sleeve.
        1) Sleeve to be 1 inch diameter schedule 40 stainless steel tubing, TP-304L, ASTM A269.
            a) Minimum wall thickness to be .065 inches.
        2) Continuously weld 4 by 4 by 1/4 inches Type 304 stainless steel, ASTM A666 flange onto each end of pipe.
            a) Drill 1 inch hole in flange to match pipe.
            b) Attach sleeve to concrete or masonry back-up with 1/4 inches concrete screw anchors.
        3) Grout solid, area around bolt where bolt penetrates veneer.
        4) Accurately locate sleeves to align with bolt locations on ladder.

GG. Anchor ladder to metal stud walls using minimum 1/2 inches stainless steel bolts, nuts and washers.

1. Verify that stud wall has been provided with adequate backing to accept ladder anchors.

HH. Install ladder safety extension post in accordance with manufacturer's instructions.

1. Mount device opposite the climbing side.
2. Provide ladder safety extension device for all ladders unless noted otherwise.

II. Install factory pre-fabricated stairs in location indicated in the Contract Documents and approved submittals.

3.3 FIELD QUALITY CONTROL

A. Tolerances (unless otherwise noted on the Drawings):

1. Frame placement, after assembly and before welding or tightening.
    a. Deviation from plumb, level and alignment: 1 inch 500, maximum.
    b. Displacement of centerlines of columns: 1/2 inches maximum, each side of centerline location shown on Drawings.

3.4 CLEANING

A. After fabrication, erection, installation, or application, clean all miscellaneous metal fabrication surfaces of all dirt, weld slag and other foreign matter.

B. Provide surface acceptable to receive field applied paint coatings specified in Specification Section 09 91 10.

END OF SECTION

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WWSECTION 05 52 23
STEEL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel handrail, stair rail and guardrail.
2. Steel guardrail gates.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 05 50 00 - Metal Fabrications.
2. Section 09 91 10 - Architectural Painting.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. U.S. Department of Justice, Architectural and Transportation Barriers Compliance Board (Access Board):
   a. Americans with Disabilities Act (ADA):
      1) Accessibility Guidelines for Buildings and Facilities (ADAAG).
2. ASTM International (ASTM):
   a. A36, Standard Specification for Carbon Structural Steel.
   b. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   c. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   d. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   e. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
3. American Welding Society (AWS):
   a. D1.1, Structural Welding Code - Steel.
4. National Association of Architectural Metal Manufacturers (NAAMM):
   a. AMP 521, Pipe Railing Systems Manual.
5. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.

B. Qualify welding procedures and welding operators in accordance with AWS.

1.3 DEFINITIONS

A. Hardware: As defined in ASTM A153/A153M.

B. Galvanizing: Hot-dip galvanizing per ASTM A123/A123M or ASTM A153/A153M with minimum coating of 2.0 oz of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

C. Guardrail: A system of building components located near the open sides of elevated walking surfaces for the purpose of minimizing the possibility of an accidental fall from the walking surface to the lower level.

D. Handrail: A horizontal or sloping rail intended for grasping by the hand for guidance or support.

E. Railing: A generic term referring to guardrail, handrail and/or stair rails.

F. Stair Rail: A guardrail, installed at the open side of stairways with either a handrail mounted to the inside face of the guardrail, or where allowed by applicable codes, with the top rail mounted at handrail height and serving the function of a handrail.

1.4 SUBMITTALS

A. Shop Drawings:

1. Fabrication and/or layout drawings.
    a. Plan showing profile, location, section and details of each railing, and type and details of anchorage system.
    b. Location and type of expansion joints.
    c. Materials of construction including shop-applied coatings.
2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.

B. Informational Submittals:

1. Certification of welders and welding procedures indicating compliance with AWS.
2. Certification that railings have been designed and fabricated to meet the loading requirements specified.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver and handle railings to preclude damage.

B. Store railings on skids, keep free of dirt and other foreign matter which will damage railings or finish and protect from corrosion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Welded railing systems:
    a. Any manufacturer meeting this Specification Section.
2. Galvanizing repair paint:
    a. ZRC Products.

2.2 MATERIALS

A. Pipe: ASTM A53, Types E or S, Grade B, or ASTM A501.

B. Steel Sheet, Bar (Pickets) and Plate: ASTM A36.

C. Galvanizing Repair Paint:

1. High zinc dust content paint for regalvanizing welds and abrasions.
2. Dried film shall contain not less than 95% zinc dust by weight.
3. ZRC Products "ZRC."

D. Expansion and Adhesive Anchors: See Specification Section 03 15 19.

E. Welding Electrodes: AWS D1.1, E70 Series.

2.3 FABRICATION

A. General:

1. Verify field conditions and dimensions prior to fabrication.

2. For fabrication of items which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled trade names and roughness.
    a. Remove blemishes by grinding and buffing or by welding and grinding, prior to cleaning, treating and application of surface finishes.
3. Form exposed work with smooth, short radius bends, accurate angles and straight edges.
    a. Ease exposed edges to a radius of approximately 1/32 inches.
    b. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
4. Form exposed connections with flush, smooth, hairline joints, using galvanized steel splice locks to splice sections together or by welding.
5. Provide for anchorage of type indicated on the Drawings or as required by field conditions.
    a. Drill or punch holes with smooth edges.
6. Design railing and anchorage system in accordance with NAAMM AMP 521 to withstand loading as required by the building code.
7. Design railings in accordance with accessibility requirements per the building code and ADAAG.

B. Custom fabricate pipe railings to dimensions and profiles indicated.
1. Guardrails:
    a. 1-1/2 inches nominal diameter pipe.
    b. Top rails and intermediate rails: Schedule 40.
    c. Vertical posts: Schedule 80.
2. Handrails mounted to walls or guardrail vertical posts: 1-1/4 inches nominal diameter Schedule 40 pipe.
3. Where details are not indicated, space intermediate rails to requirements of the building code or OSHA Standards, whichever requires the more restrictive design.
4. Space vertical posts as required by loading requirements but not more than 4 feet on-center.
    a. Avoid locating vertical posts at changes in direction of railing.
    b. Hold vertical post back from corner and provide radiused corners.
5. Space handrail brackets as required by loading requirements but not more than 4 feet on-center.
6. Base plate for vertical guardrail posts mounted to top of concrete surface:
    a. 3/8 x 6 x 6 inches square plate welded to the vertical post.
    b. Predrilled to accept four anchors.
7. Base plate for vertical guardrail post mounted to metal structure:
    a. 3/8 x 2-1/2 x 8 inches plate welded to the vertical post.
    b. Predrilled to accept two fasteners.
8. Mounting bracket for vertical guardrail post mounted to vertical concrete surface or web of metal structural member:
    a. Pair of 3/8 inches angles or bent plates welded to vertical posts.
    b. Predrilled to accept two fasteners each.
    c. Provide 1/4 x 4 inches high toe boards at elevated walkways and platforms, where indicated on the Drawings or required by OSHA Standards.
        1) Clearance between bottom of toe board and walking surface shall not exceed 1/4 IN.

C. Welded Railing Fabrication:
1. All welding to be continuous in accordance with AWS D1.1.

a. All welded railing joints shall have full penetration welds.

2. All exposed welds to be ground and buffed smooth and flush to match and blend with adjoining surfaces.
   a. NAAMM AMP 521, Type 2.
3. No ragged edges, surface defects, or undercutting of adjoining surfaces will be accepted.
4. Fit exposed ends of guardrails and handrails with solid terminations.
   a. Return ends of handrails to wall but do not attach to wall.
5. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly of units at project site.

D. Install weeps to drain moisture from hollow sections of railing at exterior locations and in high humidity areas.

1. Drill 1/4 inches weep hole in railings closed at bottom:
   a. 1 inches above walkway surface at bottom of posts.
      1) 1 inches above solid rod at removable railing sections.
   b. At low point of intermediate rails.
   c. Drill hole prior to galvanizing.
   d. Do not drill weep holes:
      1) In bottom of base plate.

E. Expansion Joints:

1. Joints to be designed to allow expansion and contraction of railing and still meet design loads required.
   a. Top rail splices and expansion joints shall be located within 8 inches of post or other support.
   b. Where railings span building expansion joints; provide a railing expansion joint in the span crossing the building expansion joint.
2. Provide expansion joints in any continuous run exceeding 20 feet in length.
   a. Space expansion joints at not more than 40 feet on center.
3. Provide minimum 0.10 inches of expansion joint for each 20 feet length of top rail for each 25 DegF differential between installation temperature and maximum design temperature.
   a. Maximum expansion joint width at time of installation shall not exceed 3/8 inches.
      1) Provide additional expansion joints as required to limit expansion joint width.
4. Provide slip-joint with internal sleeve.
   a. Extend slip joint min 2 inches beyond joint at maximum design width.
   b. Fasten internal sleeve securely to one side
      1) Provide allen-head set screw located in bottom of rail.
      2) Rivets or exposed screw heads are not acceptable.

F. Finish:

1. Hot-dip galvanize after fabrication.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to installation, inspect and verify condition of substrate.

B. Correct surface defects or conditions which may interfere with or prevent a satisfactory installation.

3.2 INSTALLATION

A. Install handrails and guardrails to meet loading requirements of the building code.

B. Install products in accordance with NAAMM AMP 521 and manufacturer's instructions.

C. Set work accurately in location, alignment and elevation; plumb, level, and true.

1. Measure from established lines and items which are to be built into concrete, masonry or similar construction.

D. Align railings prior to securing in place to assure proper matching at butting and expansion joints and correct alignment throughout their length.

1. Provide shims as required.

E. Install proper sized expansion joints based on temperature at time of installation and differential coefficient of expansion of materials in all railings as recommended by manufacturer.

1. Lubricate expansion joint splice bar for smooth movement of railing sections.

F. Provide removable railing sections where indicated on Drawings.

G. Attach handrails to walls or guardrails with brackets designed for condition.

1. Provide brackets which provide a minimum 1-1/2 inches clearance between handrail and nearest obstruction.
    a. Handrails shall not project more than 4-1/2 inches into required stairway width.
2. Anchor handrail brackets to concrete or masonry walls with 1/2 inches stainless steel adhesive anchors and stainless steel hex head bolts.

H. Anchor railings to concrete with minimum 1/2 inches stainless steel adhesive anchors with stainless steel bolts, nuts and washers unless noted otherwise in the Contract documents.

1. Where exposed, bolts shall extend minimum 1/2 inches and maximum 3/4 inches above the top nut.
    a. If bolts are cut off to required height, threads must be dressed to allow nuts to be removed without damage to the bolt or the nut.
    b. Bevel the top of the bolt after cutting to provide a smooth surface.

I. Anchor railings to metal structure with minimum 3/4 inches stainless steel bolts, nuts and washers.

J. Install toeboards to fit tight to the walking surface.

1. Attach to railing vertical post with manufacturer's standard mounting clamp:
    a. Adjustable.
    b. Designed to engage in extruded slot on back of toeboard.
2. Provide splice bars, corner splices and brackets:
    a. Manufacturer's standard items as required for a complete installation.
3. Notch toeboards at base plates or other obstructions.
4. Bottom of toeboard shall not exceed 1/4 inches above walking surface.

K. Repair damaged galvanized surfaces in accordance with ASTM A780.

1. Properly prepare surface in accordance with galvanizing repair paint manufacturer's recommendations.
2. Apply minimum 6 mils DFT of galvanizing repair paint in accordance with manufacturer's recommendations.

L. Prepare and paint railings in accordance with Specification Section 09 91 10.

M. Provide railings as required for stair construction identified in Specification Section 05 50 00.

N. Install guardrail gate plumb and level in location shown on Drawings.

1. Center gate in opening.
2. Top of gate to match top of guardrail.

3. Fasten hinges to gate and jamb post:
    a. Minimum three, 1/4 inches stainless steel countersunk machine screws per leaf.
    b. Drill and tap into railing and gate vertical posts.
4. Provide not less than two hinges per gate.
5. Install gate latch and stop on strike side of opening.
    a. Fasten to gate with 1/4 inches stainless steel countersunk machine screws.
    b. Drill and tap into gate vertical post.
    c. Drill hole in railing vertical post to receive latch pin.
6. Adjust to provide smooth operation:
    a. Self-closing and self-latching.

END OF SECTION

DIVISION 06

WOOD, PLASTICS, AND COMPOSITES

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SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rough carpentry.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 15 19 – Anchorage to Concrete
2.
3. Section 07 62 00 - Flashing and Sheet Metal.
4. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Wood Council (AWC):
   a. NDS, National Design Specification for Wood Construction.
2. The Engineered Wood Association (APA):
   a. PRP-108, Performance Standards and Qualification Policy for Structural Use Panels.
   b. U450, Storage and Handling of APA Trademarked Panels.
   c. Y510, Plywood Design Specification.
3. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.
   c. D4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   d. D4444, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters.
   e. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
4. American Wood Protection Association (AWPA):
   a. M2, Standard for Inspection of Preservative Treated for Industrial Use.
   b. M3, Standard for the Quality Control of Preservative Treated Products for Industrial Use.
   c. M4, Standard for the Care of Preservative-Treated Wood Products.
   d. T1 Processing and Treatment Standard.
   e. U1, Use Category System: User Specification for Treated Wood.
5. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI):
   a. ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roof Systems.
6. Environmental Protection Agency (EPA).
7. FM Global (FM):
   a. 1-49, Property Loss Prevention Data Sheets - Perimeter Flashing.
8. National Institute of Standards and Technology (NIST):
   a. PS 1, Quantitative NMR (Benzoic Acid).
   b. PS 20, American Softwood Lumber Standard.

9. Underwriters Laboratories, Inc. (UL):
    a. 723, Standard for Test for Surface Burning Characteristics of Building Materials.

B. Qualifications:

1. Wood Treatment Plant: AWPA M3.
2. Treated Wood Inspection: AWPA M2.

C. Miscellaneous:

1. Factory marking:
    a. Lumber:
        1) Identify type, grade, moisture content, inspection service, producing mill, and other qualities specified.
        2) Marking may be omitted, as allowed by the building code, if certificate of inspection is provided for each shipment.

1.3 SUBMITTALS

A. Shop Drawings:

1. Fabrication drawings of all fabricated items.
2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions for all products specified.
3. Certifications:
    a. Chemicals used in treatment process are registered with and approved by EPA.
    b. Moisture content of material prior to treatment: 25% maximum.
    c. Material has been kiln-dried after treatment (KDAT) to the moisture content specified.
4. Documentation of treatment of treated material in accordance with standards referenced.

1.4 DELIVERY AND STORAGE

A. Delivery, storage and handling of untreated wood products:

1. Lumber: As recommended by the grading agency indicated on the grade stamp.
2. Plywood: APA U450.

B. Delivery, storage, handling and disposal of treated wood products: AWPA M4.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Wood connectors:
    a. Simpson Strong-Tie Company, Inc.
    b. Southeastern Metals Manufacturing Company, Inc.

B. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.

2.2 MATERIALS

A. General:

1. Lumber (for framing, blocking, nailers, furring, grounds and similar members):
    a. NIST PS 20.
    b. Species:

1) Treated material: As indicated in the appropriate AWPA standard.
a) Provide species of FRTM as necessary to achieve UL rating listed.

c. Grade:
1) For nominal sizes up to and including 2 x 4: Standard and better.
2) For nominal sizes up to 2 inches thick and wider than 4 inches: #2 and better.

2. Non-structural plywood:
a. NIST PS 1.
b. C-D plugged:
1) Exposure: INT.
2) Thickness: As indicated on Drawings.
3) Touch sanded.

B. Preservative Treated Material:

1. Moisture content:
a. Prior to treatment: 25%.
b. Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:
1) Lumber: 19% maximum.
2) Plywood: 18% maximum.

2. Preservative:
a. Waterborne: AWPA T1.
b. As indicated in the appropriate AWPA standard.

3. Pressure-treat material in accordance with AWPA U1.

4. Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

C. Fire-Retardant Treated Material (FRTM):

1. Acceptable manufacturer:
a. Hoover Treated Wood Products, Inc.:
1) Interior: "Pyro-Guard".
2) Exterior: "Exterior Fire-X".

2. Maximum moisture content:
a. Prior to treatment: 25%.
b. Kiln-dry after treatment (KDAT), ASTM D4442 and ASTM D4444:
1) Lumber: 19% (KDAT).
2) Plywood: 15% (KD-15).

3. Fire-retardant preservative:
a. Provide protection against decay:
1) EPA registered for use as a wood preservative.
b. Shall not bleed-through or adversely affect bond of any finish.

4. Pressure-treat material in accordance with AWPA U1.

5. UL Classified:
a. FR-S, UL 723.
b. Exterior: No increase in classification when subjected to the Standard Rain Test, ASTM D2898.
c. Provide UL mark on each piece of FRTM.

6. Maximum flame spread rating: 25, ASTM E84.

7. Wherever practicable, material to be treated shall be manufactured in its final form prior to treatment.

D. Fasteners and Anchors:

1. Nails and screws:
   a. Dry, non-corrosive exposure: Hot dipped galvanized meeting ASTM A153 or Type 304 stainless steel.
   b. Wet, corrosive, marine, and/or below grade: Type 316 stainless steel.
2. Adhesive anchors, expansion anchors, self-tapping concrete anchors, bolts, nuts, and washers: See Specification Section 03 15 19.

E. Exterior Wall Sheathing:

   1) Acceptable manufacturer:
   2) Georgia Pacific "DensGlass Gold Fireguard" exterior sheathing.

2. Gypsum board sheathing: ASTM C1177/C1177M.
3. Water and moisture-resistant treated gypsum core.
4. Glass mat facing front and back.
   a. Fire rated "TYPE X".
5. Mold resistant: ASTM D3273.
6. Class 'A' fire rated per UL 790.
   1) Flame spread 10, smoke developed 0 when tested in accordance with ASTM E84.
   2) Non-combustible when tested in accordance with ASTM E136.
   3) Thickness: 5/8 inches.
   b. Fasteners: Type 304 self-tapping stainless steel screws, size as recommended by board manufacturers for heavy gage metal stud framing.
7. Plywood sheathing:
   a. Acceptable manufacturer:
      1) Hoover Treated Wood Products "Exterior Fire-X."
   b. Fire retardant treated plywood, UL classified FR-S, UL 723.
   c. Thickness as shown on the Drawings.
   d. Provide minimum B/C face with "B" face installed on the exterior side.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify measurements, dimensions, and shop drawing details before proceeding.

B. Coordinate location of studs, nailers, blocking, grounds and similar supports for attached work.

C. Eliminate sharp projections which would puncture roofing, flashing or underlayment material.

3.2 ERECTION AND INSTALLATION

A. General:

1. Provide preservative treated material for all wood used:
   a. Outside building.
   b. Below grade.
2. Provide fire-retardant treated material for all wood used:
   a. Inside building.
   b. Exterior building walls.
   c. Roof construction.
   d. Parapet walls.
   e. Roofing nailers.

B. Attach work securely by anchoring and fastening as indicated or required to support applied loading.
    1. Anchor wood to concrete using adhesive or expansion anchors as specified in Specification Section 03 15 19.
        a. Separate wood from direct contact to concrete with polyethylene foam gasket strip.
            1) Size: 1/4 inches by width of wood member.
            2) Owens Corning "SillSealR".
    2. Anchor wood to metal using bolts and nuts as specified in Specification Section 03 15 19.
    3. Provide flat washers under all bolt heads and nuts.
    4. Fasten plywood in accordance with APA recommendations.
    5. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
    6. Install fasteners without splitting of wood; predrill as required.
    7. Do not drive threaded friction type fasteners.
    8. Tighten bolts and lag screws at installation and retighten as required.

C. Set work to required levels and lines, plumb, true.
    1. Shim as required.
    2. Cut and fit accurately.

D. Provide wood grounds, nailers, or blocking where required for attachment of other work and surface applied items.
    1. Form to shapes indicated or required.
        a. FRTM lumber:
            1) Do not rip or mill.
            2) Cross-cutting and drilling are allowable in accordance with manufacturer's recommendations and UL requirements.
            3) Resurfacing, planing or fabrication of special shapes or profiles shall be done prior to treatment.
        b. FRTM plywood:
            1) Cross-cutting, ripping and drilling are allowable in accordance with manufacturer's recommendations and UL requirements.
        c. Light sanding of FRTM as permitted by UL to remove raised grain or prepare for finishing is allowable.
        d. Field treat cuts and holes in preservative treated material in accordance with AWPA M4 and manufacturer's published recommendations.
    2. Grounds:
        a. Dressed, key beveled lumber minimum 1-1/2 inches wide of thickness required to bring face of ground even with finish material.
        b. Remove temporary grounds when no longer required.
    3. Install roofing nailers as necessary for attachment of flashing, curbs, fascia, coping, and related accessories:
        a. Match height of nailers to insulation.
        b. Anchor nailers to resist force of 300 PLF unless required otherwise by FM Global or roofing manufacturer.
            1) Metal decking attachment:
                a) Attach base nailer to metal roof deck using self-tapping stainless steel sheet metal screws (STSMS) with plate washers or with minimum 3/8 inches Type 304 stainless steel hex head bolts with nuts and washers.
                b) Countersink heads of bolts flush with top of nailer.

2) Concrete decking attachment:
    a) Attach base nailer to concrete roof deck using minimum 3/8 inches stainless steel adhesive anchors with minimum 3 inches embedment.
    b) Countersink heads of bolts flush with top of nailer.
3) Provide size and spacing of anchorage as required to meet loading criteria specified.
    a) Fasten blocking for perimeter flashing in accordance with ANSI/SPRI ES-1 and FM Global 1-49.

c. Provide 1/2 inches vent spaces between lengths of nailers.
d. Install nailers over vapor retarder.

E. When wood has been exposed to moisture allow to completely dry out prior to covering with additional wood or another material.

F. Correct or replace wood which shows bowing, warping or twisting to provide a straight, plumb and level substrate for applications of other materials.

G. Exterior Wall Sheathing Installation:

1. Install sheathing in accordance with manufacturer's installation guidelines and fastening requirements for loading requirements noted in the Contract Documents.
2. Install sheathing with "gold side" out.
3. Use maximum lengths possible.
4. Do not tape joints between panels.
5. If sheathing surface varies more than 1/8 inches from any one panel to an adjoining panel, remove the panels and reset.
    a. If the condition persists, remove the panels and correct sub framing as required so panels align properly.
6. Drive fasteners to bear tight against and flush with surface of sheathing.
    a. Do not countersink, fracture core or puncture facers with head of fastener.

END OF SECTION

SECTION 06 17 53
SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Metal Plate Connected Wood Trusses, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Product Data:

1. Product certificates signed by officer of truss fabrication firm certifying that metal-plate-connected wood trusses supplied comply with specified requirements and shop drawings.
2. Material certificates for dimensional lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by American Lumber Standards Committee (ALSC) Board of Review.
3. Research or evaluation reports acceptable to authorities having jurisdiction that metal-plate connectors and metal-framing connectors comply with local building code.

B. Shop Drawings:

1. Indicate location, pitch, span, camber, configuration, and spacing for each type of truss required; species, sizes, and stress grades of lumber to be used; splice details; type, size, material, finish, design values, and orientation and location of metal connector plates; truss to truss girder connection details and truss bearing details.
2. Indicate permanent bracing required including location, size, and connection details.

C. Project Information:

1. Proof that erector has minimum of five (5) years of experience in installation of metal-plate-connected wood trusses.
2. Proof of fabricators participation in a recognized quality-assurance program.
3. Engineering analysis and calculations indicating design moments, shears, and other forces signed and sealed by Specialty Structural Engineer.
    a. Submit concurrent with Shop Drawings.

D. Contract Closeout Information:

1. Certificate by erector, that trusses were installed in accordance with approved erection plans and specifications.

1.3 QUALITY ASSURANCE

A. Fabricator Qualifications:

1. Minimum five years of experience in fabrication of metal-plate-connected wood trusses.
2. Participate in a recognized quality-assurance program that involves inspection by SPIB; Timber Products Inspection.; Truss Plate Institute (TPI); or other independent inspection and testing agency acceptable to Architect.

B. Metal-Plate Connector Manufacturer Qualifications:

1. Member of TPI and comply with TPI quality-control procedures for manufacture of connector plates.
2. Provide metal connector plates from one source and by a single manufacturer.

C. Erector Qualifications:

1. Experienced in wood truss installation and shall have completed wood truss installation similar in material, design, and extent to that indicated on Drawings with a record of successful in-service performance.

D. Truss Plate Institute (TPI):

1. ANSI/TPI-1 National Design Standard for Metal-Plate-Connected Wood Truss Construction
2. TPI Building Component Safety Information (BCSI) - Guide to Good Practice for Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses.
3. TPI DSB Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses

E. Reference Standards:

1. National Institute of Standards and Technology DOC PS20 American Softwood Lumber Standard
2. American Wood Council (AWC) National Design Specification for Wood Construction.

F. Provide trusses engineered by specialty structural engineer to support superimposed dead, live, and lateral, wind or seismic, loads indicated on Contract Drawings.

1. Include truss to truss girder connection design.
2. Include handling forces and show temporary bracing required during erection.
3. Proportion such that the following deflection limits are not exceeded:
   a. Live or snow: Span /360.
   b. Dead (including long term deflection) plus live or snow: span/240.
   c. Wind: Span/360.

G. Architect to review design for general conformance with intent of Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal Connector Plates:

1. Base:
   a. Alpine Engineered Products.
   b. Mitek Industries.
   c. Tee-Lok.
   d. Truswal Systems.

B. Metal Framing Anchors:

1. Base:
   a. United Steel Products.

C. Other manufacturers desiring approval comply with Section 01 25 13.

2.2 MATERIALS

A. Dimensional lumber: Comply with DOC PS20, “American Softwood Lumber Standard,” and with applicable grading rules of inspection agencies certified by ALSC’s Board of Review.

1. Inspection agencies, and abbreviations used to reference them, include following:
   a. NELMA Northeastern Lumber Manufacturers Association.
   b. NLGA National Lumber Grades Authority.
   c. SPIB Southern Pine Inspection Bureau.
   d. WCLIB West Coast Lumber Inspection Bureau.
   e. WWPA Western Wood Products Association.

2. Provide lumber with each piece factory marked with grade stamp of inspection agency, evidencing compliance with grading rule requirements, and identifying grading agency, grade, species, moisture content at time of surfacing and mill.
3. Provide dressed lumber, S4S, manufactured to actual sizes required by DOC PS20 with 19% maximum moisture content at time of dressing.
4. Provide dimension lumber of any species for truss chord and web members, graded visually or mechanically, and capable of supporting required loads without exceeding allowable design values.

B. Nails, wires, brads, and staples: Comply with ICC-ES AC233.

C. Power driven fasteners: Comply with ICC ESR-1078.

D. Metal framing anchors: Type, size, metal, and finish indicated.

2.3 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate connector plates from hot-dipped galvanized sheet steel complying with ASTM A653, G60; Grade-33 and not less than 0.0359 inchesthick.

C. Fabricate metal connector plates to size, configuration and thickness required to withstand design loadings for types of joint designs indicated.

D. Assemble truss members in design configuration indicated using jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances of ANSI/TPI-1.

1. Position members to produce design camber indicated.

E. Connect truss members by metal connector plates located and securely embedded simultaneously into both sides of wood members by air or hydraulic press.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Consider that full structural capacity of trusses is not realized until structural assembly is complete.

1. Until permanent elements of roof are complete, temporary bracing will be required. Install truss bracing according to recommendations of TPI and as indicated by truss fabricator.
2. Do not install wood trusses until supporting construction is in place and braced.

B. Splice trusses delivered to project site in more than one piece before installing.

C. Install trusses plumb, square and true to line, and securely fasten to supporting construction.

D. Space, adjust, and align trusses in location before permanently fastening. Space trusses not more than 24 inchesOC.

E. Anchor trusses securely at bearing points using metal framing anchors. Install fasteners through each fastener hole in metal framing anchor according to manufacturer’s fastening schedule and written instructions.

F. Securely connect each truss ply for forming built-up girder trusses.

G. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

H. Install wood trusses within tolerances of ANSI/TPI-1.

I. Do not cut or remove truss members.

J. Do not alter trusses in field.

K. Repair damaged galvanized coatings with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

END OF SECTION

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural cabinetwork.
2. Solid Surface Material window stools and countertops.
3. Resilient base.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 05 50 00 - Metal Fabrications.
2. Section 07 92 00 - Joint Sealants.
3. Section 08 14 16 - Flush Wood Doors.
4. Section 08 81 00 - Glass and Glazing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Americans with Disability Act (ADA):
   a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
2. American National Standards Institute (ANSI):
   a. A161.2, Decorative Laminate Countertops, Performance Standards for Fabricated High Pressure.
   b. A208.1, Particleboard.
   c. A208.2, Medium Density Fiberboard (MDF) for Interior Applications.
3. American National Standards Institute/American Hardboard Association (ANSI/AHA):
   a. A135.4, Basic Hardboard.
4. ASTM International (ASTM):
   a. D4442, Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
   b. D4444, Standard Test Method for Laboratory Standardization and Calibration of Hand-Held Moisture Meters.
   c. F1861, Standard Specification for Resilient Wall Base.
5. Architectural Woodwork Institute (AWI):
   a. Architectural Woodwork Quality Standards:
      1) Section 300, Standing and Running Trim.
6. American Wood Protection Association (AWPA):
   a. U1, Use Category System: User Specification for Treated Wood.
7. Builders Hardware Manufacturers Association (BHMA).
8. Hardwood Plywood and Veneer Association (HPVA):
   a. HP-1, Standard for Hardwood and Decorative Plywood.
9. National Electrical Manufacturers Association (NEMA):
   a. LD 3, High-Pressure Decorative Laminates (HPDL).

B. Qualifications:

1. Fabricator shall have minimum of 10 years experience in design and fabrication of architectural cabinetwork with minimum of three successfully completed projects with similar scope in the last 2 years.

C. Miscellaneous:

1. Construction details, fastening, tolerances and workmanship: AWIpremium grade standards with exceptions indicated.

1.3 DEFINITIONS

A. Architectural Cabinetwork: Millwork.

B. Exposed Surfaces:

1. All surfaces visible when doors and drawers are closed, inside of doors, and:
   a. Door and drawer fronts and their edges.
   b. Exposed end.
   c. Countertop and backsplash and their exposed edges.
   d. Face frame (if used).
   e. Interior of open cabinets.
   f. Toe kick not to be covered by resilient base .
   g. Wall mounted adjustable shelves.
   h. Bottom of wall case over 4 feet above floor.
   i. Top of wall and tall cases below 6 feet above floor.

C. Concealed Surfaces:

1. Surfaces not visible after installation, and:
   a. Web frames.
   b. Dust panels.

D. Semi-Exposed Surfaces:

1. All other surfaces not exposed or concealed.

1.4 SYSTEM DESCRIPTION

A. Fabricated cabinets including all hardware, countertops, and finishing thereof.

1.5 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
2. Fabrication drawings and details showing compliance with this Specification Section.

B. Samples:

1. Plastic laminate color and finish samples for Engineer's selection.
2. Solid Surface Material manufacturers complete line of color samples including custom colors.
3. Resilient base manufacturer's full range of colors and styles for Engineer's selection.

C. Informational Submittals:

1. Millwork fabricator experience qualifications.
2. Listing of millwork fabricators projects within last two years with similar scope.
3. Solid Surface Material fabricator's qualifications.
4. Warranty from Solid Surface Material manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all millwork items window stoolsand countertops to the Project Site and store in the area in which items will be installed.

1. Building areas to receive millwork items shall be enclosed, weathertight and conditioned to a relative humidity between 25% and 55% before, during and after installation.
2. Remove any plastic packaging or wrapping from millwork upon delivery to Project Site.
3. Protect stored items from damage with vapor-permeable covering during storage.
4. Allow material to acclimate to the surrounding environment a minimum of 96 hours prior to installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Plastic laminate:
   a. Formica Corporation.
   b. Nevamar by Panolam Surface Systems.
   c. Wilsonart Engineered Surfaces.
2. Plastic overlay panel products:
   a. Simpson Timber Co.
   b. Sel-Ply Division/Medford Corp.
   c. Weyerhaeuser Company
   d. Formica Corporation.
3. Cabinet hardware:
   a. EPCO.
   b. Faultless.
   c. Grant.
   d. Ives by Allegion.
   e. Knape & Vogt Manufacturing Company.
   f. McKinney.
   g. National Lock Co.
   h. Rockford Process Control.
   i. Stanley Black & Decker, Inc.
   j. Stylmark, Inc.
   k. Webber-Knapp Company.
4. Solid Surface Material:
   a. Avonite by Aristech Surfaces LLC.
   b. DuPont.
   c. Formica Corporation.
   d. Wilsonart Engineered Surfaces.
5. Resilient base:
   a. Armstrong Flooring, Inc.
   b. Burke Flooring.
   c. FLEXCO Corporation.
   d. Johnsonite.
   e. Roppe Corporation.

f. VPI Corporation.

2.2 MATERIALS

A. Plastic Laminate:

1. NEMA LD 3 high-pressure laminate, matte finish.
2. Countertops and backsplashes and their edges: Grade FR50, 0.050 inches thick.
3. All other exposed surfaces: Grade GP28, 0.028 inches thick.
4. Semi-exposed backer sheet: Grade CL20, 0.020 inches thick; color to match plastic overlay.
5. Concealed backer sheet: Grade BK20, 0.020 inches thick.
6. For fire rated use Grade FR32, 0.032 inches thick backer sheet.

B. Plastic Overlay:

1. Resin impregnated paper overlay hot press cured onto substrates with backer/balance sheet.
2. Conform to NEMA requirements for "general purpose" decorative board (not "light duty" liner type).
3. Satin finish: Opaque color.
4. Resin: Polyester; phenolic resin may be used on concealed surfaces.
5. Color: White.

C. Particleboard:

1. Three-ply, medium density industrial particleboard.
2. ANSI A208.1: Grade M-2 or M-3.
3. Density: 45 pcf minimum.
4. Particleboard used for countertops:
   a. ANSI A161.2.
   b. Moisture resistant.
5. Fire rated, class I carrying UL stamp.

D. Fiberboard:

1. Medium density wood fiberboard.
2. ANSI A208.2: Interior Grade M.

E. Hardboard:

1. Tempered, smooth on both sides.
2. ANSI/AHA A135.4: Class 1, S2S.

F. Hardwood Plywood:

1. Species: Red oak.
2. Plain sliced.
3. Veneer or particle core.
4. HPVA HP-1, Grade A.
5. Hardwood plywood for drawer boxes:
   a. Species: Alder or Birch.
   b. HPVA HP-1, Grade A.
   c. States Industries "Appleply".

G. Plywood: Softwood plywood, A grade.

H. Hardwood:

1. Solid, S4S.
2. AWI Section 300, premium grade, Grade I, for exposed surfaces.
3. Exposed: Species to match veneer plywood unless noted otherwise on Drawings.
4. Other locations: Any hardwood.

I. Preservative Treated Lumber:

1. Preservative: Waterborne.
2. Moisture content:
   a. Prior to treatment: 25%.
   b. Kiln-dry after treatment (KDAT), ASTM D4442, ASTM D4444: 19% maximum.
3. Pressure treat material in accordance with AWPA U1, Use Category UC2.

J. Resilient Base:

1. Rubber or vinyl, top set, coved type.
2. 1/8 by 4 inches, 1/4 inches wide at bottom.
3. Factory-formed external and internal corners.
4. Continuous rolls, minimum 95 feet long.
5. ASTM F1861.

K. Sealant:

1. Silicone.
2. See Specification Section 07 92 00.

2.3 FABRICATION

A. General:

1. Custom shop or factory built casework, complete with all hardware, accessories, countertops and bases in sizes and configurations indicated.

B. Cabinetwork:

1. Style: Reveal overlay doors and drawer fronts overlapping case body with uniform reveal at all edges.
2. Case body:
   a. All joints glued.
   b. Top and bottom (and fixed horizontals):
      1) Lock jointed and screwed.
      2) Dadoed or rabbeted into ends/dividers.
      3) Doweled at approximately 2-1/2 inches on-center.
   c. Back: Dadoed into top, sides, and bottom.
   d. Fixed small compartment dividers: Dadoed.
3. Drawers (with subfront):
   a. All joints glued.
   b. All corners:
      1) Dovetailed or doweled.
      2) Front corners dovetailed and back corners lock jointed.
      3) Sides dadoed for front and back and all joints nailed, stapled or screwed.
   c. Bottom: Dadoed into all four sides.
   d. Front: Screwed onto subfront.
   e. Top edges of drawer box rounded.
4. Drawers (without subfront):

a. All joints glued.
b. Front corners dovetailed or doweled.
c. Back corners:
1) Dovetailed, doweled, or lock jointed.
2) Sides dadoed for back and corner nailed or screwed.
d. Bottom: Dadoed into all four sides.
e. Top edges of drawer sides and back rounded.

5. Solid Surface Material window stools and countertops:
a. Use maximum size sheet to eliminate joints.
b. Joints shall be not closer than 24 inches to sinks or other cut-outs.
c. Refer to Drawings for special edge treatment.
d. Ease all exposed edges.
e. 1/2 inches thick built up to 1-1/4 inches at exposed edges.
f. Backsplashes:
1) Same material and thickness as countertop.
2) 4 inches high.
3) Provide wherever top abuts wall.
g. Color:
1) To be selected by Engineer from manufacturer's complete offering of colors and patterns.
2) Allow for minimum of two base color selections with two accent colors.

6. Use no blocking or fasteners in exposed or semi-exposed locations.

C. Hardware:

1. General:
a. Provide handles, pulls, latches, locks, and other operating devices in accordance with the ADAAG.

2. Hardware for hinged doors:
a. Hinges:
1) Five-knuckle, wraparound type with hospital type tips.
2) Not less than 2-1/2 inches long.
3) Minimum three screws each leaf.
4) For doors up to 48 inches high: Two hinges.
5) For doors over 48 inches high: Three hinges.
6) Finish:
a) Stainless steel, BHMA 630.
7) Hinge: Rockford Process Control "Overlay."
b. Catch:
1) Heavy duty, roller catch.
2) Case and strike: Wrought steel.
3) Roller: Rubber.
4) Ives 338.
5) Finish: Bright nickel plated, clear coated.

3. Hardware for drawers:
a. Slides: KV 8400 series; 100 pound capacity, precision steel ball bearings, positive closing and pull out stops, drawer removable without use of tools; telescoping full extension slides, epoxy-coated with white finish.

b. Lock: Provide where indicated.
c. For file drawers: Label holder and file hanger frame.

4. Pulls:
   a. Stainless steel wire.
   b. 4 inches centers.
   c. 5/16 inches (8 mm) DIA.
   d. Provide two on drawers over 18 inches wide.
   e. Finish:
      1) Stainless steel, BHMA 630.
      2) Color: To be selected by Engineer.
5. Locks:
   a. Pin tumbler cylinder cam locks.
   b. Material: Brass.
   c. Finish: Chrome plated, US 26D.
   d. National C8100 series.
   e. Provide two keys for each lock.
   f. Master key and grand master key as directed.
6. Countertop support brackets:
   a. Cold rolled steel.
   b. Size:
      1) Nominal 22 inches deep by 14 inches high.
      2) 3/4 inches wide.
   c. Tested to meet or exceed ANSI performance standards as established by BHMA.
      1) Load Rating: 1200 pounds per pair.
   d. Similar to Knape & Vogt "208 Series Ultimate L-Bracket."
   e. Finish:
      1) Corrosion resistant powder coating.
      2) Color: Titanium.

D. Plastic Laminate Casework Fabrication:

1. Finishes for non-fire-rated cabinets:
   a. All exposed surfaces: Plastic laminate.
   b. All semi-exposed surfaces not covered with plastic laminate backer sheet (except hardwood): Plastic overlay.
2. Finishes for fire-rated cabinets:
   a. All exposed and semi-exposed surfaces (except hardwood): Plastic laminate.
   b. Edges of doors, drawer fronts and case body members: Plastic laminate.
   c. Exposed hardwood: See this Specification Section.
3. Edges:
   a. Edges of case body members: 1 mm PVC.
   b. All other exposed and semi-exposed edges: 3 mm PVC.
4. Case body members (except backs not exposed):
   a. Minimum 3/4 inches thick particleboard.
   b. Base unit top:
      1) Use either full subtop or web frame.
      2) Web frames: Hardwood.
   c. Provide drawer lock rails at all drawers.

d. Provide backs on all cabinets.

5. Unexposed case back:
   a. Tempered hardboard.
   b. Minimum 1/4 inches thick.
   c. Full bound: Capture and glue back panel in dado at top, sides and bottom of case.
6. Shelves:
   a. Minimum 3/4 inches thick particleboard.
   b. 1 inches thick if over 36 inches between supports.
7. Doors:
   a. Particleboard:
      1) Up to 26 inches wide or 48 inches high: 3/4 inches thick.
      2) Up to 36 inches wide or 66 inches high: 1-1/4 inches thick.
8. Drawers:
   a. Fronts: 3/4 inches thick particleboard.
   b. Subfront, sides and back: 1/2 inches thick hardwood plywood.
   c. Bottom:
      1) Minimum 1/4 inches thick hardboard, captured four sides with 3/8 inches standing shoulder.
      2) Over 18 inches wide provide intermediate reinforcing rails.
9. Case base:
   a. Separate ladder style base.
   b. Preservative treated lumber.
   c. Provide concealed fastening of cabinet body to base.
      1) Fasteners through bottom of casework will not be accepted.
10. Small compartment dividers and dust panels: 1/4 inches thick hardboard.
11. Filler panels and scribe pieces: Particleboard; provide as required to fit standard size units to space.

E. Case Configuration:

1. Similar reveal, approximately 1/4 inches at all sides, top and bottom of doors and drawer fronts, and between doors and drawer fronts in same unit.
2. Double door units: No vertical rail or divider between doors unless called for or unless locks are called for.
3. Toe space:
   a. 4 inches high by approximately 3 inches deep.
   b. Provide on front of each base unit unless otherwise noted.
4. Pairs of sliding doors: Equal width; overlap 1 inch.
5. Countertop: Overhang front and exposed ends 1 inch.
6. Hardware mounting:
   a. Drawers: Center pull in front, horizontally.
   b. Drawers with two pulls: Set pulls at 1/4 points.
   c. Swinging doors:
      1) Set pull in swing side corner:
         a) Base units: Horizontally at top of door.
         b) Wall units: Vertically at bottom of door.
         c) Tall units: Vertically, centered at 40 inches above finished floor.
7. Adjustable shelves:

a. Use drilled hole supports.
b. Depth: 1/2 inches less than inside cabinet depth.
c. Width: 1/8 inches, maximum, less than inside cabinet width.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify dimensions at site.

B. Verify locations of items specified in other Specification Sections.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with the ADAAG.

1. Provide sizes, heights and clearances required for accessibility compliance.

C. Provide balanced construction on each plastic laminated item.

D. Use manufacturer's printed instructions or drawings in all cases where items or details are not indicated.

E. Provide all trim, fillers, closures, stands, supports, sleeves, collars, escutcheons, brackets, braces or other miscellaneous items required for complete installation.

F. Test and adjust for satisfactory operation.

G. Seal components with silicone sealants in accordance with AWI Standards.

1. Seal joints in plastic laminate countertops before assembly.
2. Seal joints between backsplashes and endsplashes and countertops.
3. Seal joints where backsplashes and endsplashes meet adjoining surfaces.

H. Adjust hinges so doors hang straight.

I. Resilient Base:

1. Install base after cabinets have been leveled and adjusted.
2. Provide base at toe spaces, exposed cabinet ends, knee space panels or other intersections of floor and vertical casework surfaces, unless noted otherwise.
3. Set base straight and true.
4. Fit into breaks and recesses.
5. Provide factory-formed outside corners; miter inside corners.
   a. Make joints tight.
6. Install with top edge level and bottom edge in firm contact with floor.

J. Install Solid Surface Material in accordance with manufacturer's recommendations.

3.3 FIELD QUALITY CONTROL

A. Protect Solid Surface Material during construction with minimum 1/8 inches hardboard.

END OF SECTION

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DIVISION 07

THERMAL AND MOISTURE PROTECTION

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SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Building insulation.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 09 29 00 - Gypsum Board.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C272/C272M, Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions
   b. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   c. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   d. C578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
   e. C665, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   f. D1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
   g. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
2. Underwriters Laboratories, Inc. (UL):
   a. Building Materials Directory.

B. Mock-Ups:

1. Provide insulation for mock-ups required in Specification Section 04 22 00.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturer's recommendations on sealants, tapes and mastics.

B. Informational Submittals:

1. Certification from insulation manufacturer stating that insulation proposed is acceptable for intended use per the Drawings.

1.4 SITE CONDITIONS

A. For purposes of this Specification Section, design frost line for this Project is 42 inches below grade.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Rigid extruded polystyrene board insulation:
   a. Dow.
   b. DiversiFoam Products.
   c. Owens Corning.
2. Blanket or batt thermal insulation:
   a. Owens Corning.
   b. USG Corporation.
   c. CertainTeed.
3. Sound control insulation:
   a. ROCKWOOL Group.
   b. Thermafiber by Owens Corning.
4. Vapor retarder:
   a. Raven Industries, Inc.
   b. Reef Industries, Inc.
   c. Fortifiber Building Systems Group, Inc by Henry Company.
   d. Alumiseal.

2.2 MATERIALS

A. General:

1. Foam plastic insulation used in buildings and structures shall comply with the requirements of the building code.
   a. Surface burning characteristics: ASTM E84.
   b. Flame spread index: Maximum 75.
   c. Smoke developed: Maximum 450.

B. Rigid Polystyrene Board Insulation:

1. Extruded: ASTM C578, Type IV.
   a. Water vapor transmission: ASTM E96/E96M, 1.1 perm-IN maximum.
   b. Water absorption: ASTM C272/C272M, 0.3% maximum.
   c. Thermal resistance: ASTM C518 at 75 degrees F mean temperature, 5.0/IN.
2. Provide insulation designed for intended use.
   a. Perimeter insulation.
      1) Similar to Dow "Styrofoam PERIMATE."
      2) Compressive strength: ASTM D1621, 30 psi.
      3) Thickness:
         a) Perimeter insulation: See drawings.
      4) Edges:
         a) Long edge: Shiplap.
         b) Short edge: Square.
   b. Cavity insulation:
      1) Similar to Dow "CAVITYMATE."
      2) Compressive strength: ASTM D1621, 15 psi.
      3) Thickness: 2 inches.

4) Edges: Square.

C. Sealant and Mastic (for setting polystyrene and/or polyisocyanurate insulation board): Manufacturer's recommended standard.

D. Blanket or Batt Thermal Insulation:

1. Glass or other inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
2. Unfaced:
   a. ASTM C665, Type 1.
3. Minimum thickness as noted on Drawings.

E. Vapor Retarder:

1. Fire rated, reinforced, 3 ply, Class 1 material.
2. Perm rating: Not exceeding 0.035 grains/HR-FT^2-IN-Hg when determined in accordance with ASTM E96/E96M.
3. Griffolyn "TX-1200FR."

F. Vapor Retarder Tape: As recommended by vapor retarder manufacturer.

G. Sound Control Insulation:

1. Mineral wool batts.
   a. ASTM C665, Type I.
   b. UL listed when used in fire rated construction.
2. Density: Minimum 2.5 pcf.
3. Sound Reduction, ASTM C423.
   a. Minimum NRC for 3 inches thick material: 1.05.
4. Thermafiber “SAFB”.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:

1. Insulate full thickness over surfaces to be insulated.
2. Fit tightly around obstructions, fill voids.
3. Cover all penetrations (electrical junction boxes, switch boxes, piping, conduits, etc.) with insulation, taking care not to compromise the workings of the device.
4. Fit butted joints of batt or blanket insulations tightly together.
5. Apply single or double layer to achieve total thickness.
   a. If double layer is provided, stagger all joints minimum 12 inches.
6. Do not use broken or torn pieces of insulation.
7. Install so that completed installation is vapor tight.
   a. Seal all joints.
   b. Seal to abutting materials to maintain vapor retarder integrity.
   c. Provide manufacturer’s recommended vapor retarder tape for use with faced batt insulation or separate vapor retarder.
      1) If vapor retarder tape fails to adhere to any surface, apply sprayed-on adhesive as recommended by tape manufacturer to promote adhesion.
   d. Provide manufacturer’s recommended solvent-free sealant compatible with insulation board for rigid board insulation.

1) Tape is not acceptable for use with rigid board insulation.

C. Blanket or Batt Insulation using Separate Vapor Retarder Sheet in Exterior Stud Wall Systems:

1. Verify that all piping, conduit, electrical box and other in-wall work is complete prior to installing insulation and vapor retarder.
2. Install insulation friction fit between studs.
3. Tightly butt ends.
4. Install vapor retarder to warm side of building exterior wall.
   a. Completely seal each wall area to surrounding construction.
5. Install vapor retarder vertically.
   a. Use widest practical sheet.
   b. Install in continuous sheets, floor to structure above, without horizontal joints.
   c. Fold flaps of vapor retarder over studs.
   d. Tape flaps together continuously.
   e. Tape bottom and top edges to structure continuously.
   f. After installation of any additional conduit, boxes, piping or other items within wall system, repair all tears or penetrations of vapor retarder with vapor retarder tape prior to installation of gypsum board.

D. Blanket or Batt Insulation with Facing:

1. Set with facing to winter warm side of wall.
   a. Install with facing flanges over the edge of the framing member.
   b. Do not obstruct ventilation spaces.
2. Fill all miscellaneous voids and where indicated on Drawings.
3. Tape joints and ruptures in vapor retarder.
4. Use vapor retarder tape and seal each area of insulation to surrounding construction to assure continuous vapor-tight installation.
5. At Contractor's option, provide blanket or batt insulation without vapor retarder and provide separate vapor retarder as specified.

E. Rigid Board Polystyrene Insulation on Exterior Walls:

1. Install continuously without interruption in single layer.
2. Set solidly in mastic.
3. Make all joints tight.
4. Cut and fit insulation at corners, and at penetrations, connections, etc.
5. Seal all joints with sealant applied continuously to edges of pieces before installation or apply sealant bead continuously to joint after installation.
6. Cover penetrations or connections which remain exposed after insulation is in place and seal with expanding foam sealant for a distance of 6 inches on each side.
7. If no covering is indicated on Drawings, cover entire exposed surface with 1/2 inches thick gypsum board.
8. Provide support for gypsum board at minimum 24 inches on-center.

F. Rigid Board Insulation in Cavity Walls:

1. Do not proceed with installation until subsequent work which conceals insulation is ready to be performed.
2. Set each piece of insulation flush with the abutting piece to eliminate ledges in the face of the insulation.
3. Install mastic on face of concrete or masonry back-up in accordance with mastic and insulation manufacturer's recommendation.

4. Press courses of insulation between wall ties (horizontal reinforcing) with edges butted tightly both ways.
5. Set units firmly into mastic.
6. Seal all horizontal and vertical joints with sealant recommended by insulation manufacturer.
7. Do not use damaged insulation.

G. Rigid Insulation at Perimeter Below Grade :

1. Install insulation below grade on outside face of foundation walls.
    a. Install in mastic with tight joints.
2. Where footings are located below the design frost line, extend insulation down to the design frost line.
    a. Where indicated on the Drawings, extend beyond the design frost line.
3. Where footings are located at the design frost line, extend insulation down to top of footing or as indicated on Drawings.
4. Protect insulation from damage and/or displacement during backfilling and/or pouring of floor slab.

H. Sound Control Insulation:

1. Install friction fit between studs.
2. Do not obstruct ventilation spaces.
3. Fill all miscellaneous voids unless noted otherwise on Drawings.
4. After installation of conduit, boxes, piping or other items within wall system, reposition displaced insulation and fill all voids.

3.2 FIELD QUALITY CONTROL

A. Repair or replace damaged insulation and/or vapor retarder as directed by Engineer.

B. Provide minimum cover of 5/8 inches Type X gypsum board over foam insulation exposed to the building interior.

END OF SECTION

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SECTION 07 26 00
UNDER SLAB VAPOR RETARDER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Under slab vapor retarder.

B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 302.2R, Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
2. ASTM International (ASTM):
   a. E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
   b. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Product data sheet on vapor retarder sheet and vapor retarder tape.
   c. All accessories proposed for use.
   d. Manufacturer's installation instructions.

B. Informational Submittals: Manufacturer's recommendation on vapor retarder tape.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Vapor retarder:
   a. Fortifiber Building Systems Group, Inc. by Henry Company.
   b. Layfield Group, Ltd.
   c. ISI Building Products.
   d. Raven Industries, Inc.
   e. Reef Industries, Inc.
   f. Stego Industries, LLC.
   g. W.R. Meadows, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Vapor Retarder:

1. ASTM E1745, Class A.
2. Thickness: Minimum 15 mil.
3. Water vapor permeance: 0.02 maximum.

2.3 ACCESSORIES

A. Pipe Boots: Manufacturer's standard boot fabricated to maintain the integrity of the vapor retarder system.

B. Vapor Retarder Tape: As recommended by vapor retarder manufacturers.

PART 3 - EXECUTION

3.1 PREPARATION

A. Base material over which vapor retarder is to be installed shall be level, compacted and free of debris, foreign objects or other deleterious materials.

B. Surfaces at perimeter and penetrations of vapor barrier shall be clean, smooth and free of sharp objects, fins or projections.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions, ASTM E1643 and ACI 302.2R.

B. Provide vapor retarder where indicated on the Drawings.

1. Place continuous vapor retarder above granular fill subgrade material, unless noted otherwise.

C. Lap minimum 6 inches and seal in accordance with ASTM E1643 and manufacturer's recommendations.

D. Extend to extremities of area and seal to adjacent elements.

E. Seal all penetrations: Provide pipe boot for all pipes or conduit penetrating the floor slab.

3.3 FIELD QUALITY CONTROL

A. Ensure proper precautions are implemented to prevent damage to installed vapor retarder membrane prior to and during pouring of concrete floor slab.

B. Inspect vapor retarder immediately prior to placement of concrete.

1. Patch all punctures, tears, holes, etc.
    a. Patch small punctures with vapor retarder tape as allowed by ASTM E1643 and manufacturer's recommendations.
    b. Repair larger damage with additional layer of vapor retarder.
        1) Lap repairs minimum 6 inches beyond extent of damage in all directions.
        2) Seal perimeter of patch with vapor retarder tape or as recommended by manufacturer.

END OF SECTION

SECTION 07 27 43
VAPOR RESISTIVE AIR BARRIER

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Vapor Resistive Air Barrier, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM E96 Test Methods for Water Vapor Transmission of Materials.
2. ASTM E2178 Test Methods for Air Permeance of Building Materials.
3. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
4. ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds.
5. ASTM D1876 Test Method for Peel Resistance of Adhesives.
6. ASTM E2357 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

B. International Code Council Evaluation Service, Inc.: ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.

C. National Fire Protection Association (NFPA):

1. NFPA 285, Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

1.3 SUBMITTALS

A. Shop Drawings:

1. Elevations showing locations and extent of air barrier.
2. Include details for substrate joints and cracks, counterflashing strip, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction.
3. Details and isometrics at openings showing layouts of Air Barrier Flashings and sequence of installation.

B. Product Data:

1. Manufacturer’s literature indicating specified material and required components.

C. Project Information:

1. Written documentation of applicator’s qualifications.
2. Minutes of Preinstallation Conference.

D. Contract Closeout Information:

1. Installer Warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Air and vapor barrier systems shall be manufactured by firm with minimum of 20 years of experience in production of waterproofing.
2. Obtain primary air barrier materials and air barrier accessories from single source from single manufacturer.

B. Installer Qualifications:

1. Minimum five years of continued experience in successful installation of vapor and water resistive air barrier products on similar project applications.

C. Preinstallation Conference:

1. See Section 01 31 19.

1.5 WARRANTY

A. Installer five-year warranty for air and vapor barrier and accessories have been installed in accordance with manufacturer's recommendations, and that components used in this section have been sourced from one manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Vapor Resistive Air Barrier:

1. Base:
   a. Henry Company.
2. Optional:
   a. Carlisle Coatings and Waterproofing.
   b. GCP Applied Technologies.
   c. Tremco.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Air Barrier System:

1. Air barrier capable of performing as a continuous, vapor resistive air barrier.
2. Design system to accommodate substrate movement and to seal to expansion and control joints.
3. Select components to accommodate construction material changes, penetrations, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air Permeance:

1. Maximum 0.004 cubic feet per minute per square foot 0.3 water pressure differential (1.57 psf), as tested in accordance with ASTM E2178.

C. Vapor Permeance:

1. Maximum 0.1 perm when tested in accordance with ASTM E96.

D. Exposure Rating:

1. Provide material with appropriate exposure rating to suit construction schedule.

E. Application Window:

1. Provide standard or low temperature wall membrane based upon ambient weather conditions at time of installation.
2. Verify specialty product meets design criteria of standard product.
3. Submit for approval.

2.3 MATERIALS

A. Self-adhesive membrane:

1. 40 mil rubberized asphalt bonded to composite aluminum and polyethylene film facer.
2. Base Product:

a. Henry Blueskin Metal Clad.

3. Optional Products:
   a. Carlisle Fire Resist 705 FR-A.
   b. GCP Perm-A-Barrier Aluminium Wall Membrane.

B. Optional Fluid applied membrane:

1. 40 dry MIL elastomeric membrane.
2. Base Product:
   a. Henry Air Bloc 16MR.
3. Optional Product:
   a. Carlisle Fire Resist Barritech NP.
   b. Tremco ExoAir 130.

C. Transition Membrane:

1. Self-adhesive.
2. Compatible with air barrier and adjacent substrate.
3. As recommended by air barrier manufacturer.

D. Termination Mastic:

1. Rubberized asphalt-based mastic.
2. Bituthene Mastic.
3. Manufacturer's recommended termination for non-asphaltic products.

E. Primer:

1. Water based latex.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine conditions for compliance with requirements for installation, tolerances and other specific conditions affecting performance of air barrier.

B. Substrate to be smooth and free of voids, spalled areas, and sharp protrusions.

C. Masonry Substrates:

1. Fill voids, holes, and mortar joints, with lean mortar mix, non-shrinking grout or parge coat.
2. Verify that concrete has cured and aged for minimum time period recommended by air barrier manufacturer.
3. Verify that concrete is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D4263.
4. Strike masonry joints smooth and completely fill with mortar.

D. Exterior Sheathing Panels:

1. Pre-treat joints with reinforced self-adhesive tape or mesh style wallboard tape.
2. Caulk gaps greater than 1/4 inches.

E. Remove deleterious materials from surfaces to be covered.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 INSTALLATION

A. Install according to manufacturer's instructions.

B. Perform work only when existing and forecast weather conditions are within limits established by manufacturer.

C. Join air barrier in an airtight and flexible manner to air barrier material of adjacent systems, allowing relative movement of systems due to thermal and moisture variations and creep between:

1. Foundation and walls.
2. Walls and windows or doors.
3. Different wall systems.
4. Wall and roof.
5. Wall and roof over unconditioned space.
6. Walls, floors and roof across construction, control, and expansion joints.
7. Walls, floors and roof to utility, pipe, and duct penetrations.

D. Air and Vapor Barrier Membrane:

1. Primer: Apply at rate recommended by manufacturer prior to membrane installation. Allow primer to dry completely before membrane application.
2. Sheet Membranes:
   a. Apply membrane horizontally or vertically and press firmly into place with hand roller.
   b. Start at the bottom of vertical surfaces and work up.
   c. Do not reverse shingle membranes or detail tape.
   d. Stagger end lap seams.
3. Fluid Applied Membranes:
   a. Spray or trowel apply continuous uniform film using multiple, overlapping passes to ensure even thickness and coverage.
   b. Carry membrane into openings minimum 3 inches.
   c. Seal brick ties and penetrations as work progresses.

E. Transition Membrane:

1. Install mastic at terminations, substrate transitions, penetrations and overlaps according to manufacturer's standard details.
2. Overlap fluid applied membrane onto each surface at beams, columns, and joints.
3. Tie in to window and door frames, spandrel panels, roof and floor intersections, and changes in substrate.
4. Seal top edge of flashing with termination mastic.

3.3 PROTECTION

A. Schedule work to ensure that system is covered as soon as practicable.

1. Protect system from damage during subsequent operations.

B. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer.

1. Apply temporary UV protection if system cannot be covered within prescribed period.
2. Replace air barrier if determined be damaged by UV exposure by Manufacturer.
3. Replace air barrier exposed to UV for longer than recommended period.

C. Clean spills, stains, and soiling from construction that would be exposed in completed work as recommended by manufacturer of affected construction.

D. Remove masking materials after installation.

END OF SECTION

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SECTION 07 42 16
PREFORMED METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Preformed Metal Panels, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A653 Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
2. ASTM A755 Specification for Steel Sheet, Metallic Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products
3. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Apparatus
4. ASTM B209 Specification for Aluminum and Aluminum Alloy Sheet and Plate
5. ASTM C645 Specification for Nonstructural Steel Framing Members
6. ASTM C754 Specification for Installation of Steel Framing Members to Receive Screw Attached Gypsum Panel Products
7. ASTM C920 Specification for Elastomeric Joint Sealants
8. ASTM C1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
9. ASTM D968 Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive
10. ASTM E72 Standard Test Methods of Conducting Strength Tests of Panels for Building Construction
11. ASTM E84 Test Methods for Surface Burning Characteristics of Building Materials
12. ASTM E119 Test Methods for Fire Tests of Building Construction and Materials
13. ASTM E1996 Specification for Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Windborne Debris in Hurricanes

B. American Architectural Manufacturer's Association (AAMA):

1. AAMA 501.1 Standard Test Method for Exterior Windows, Curtain Walls, and Doors for Water Penetration Using Dynamic Pressure
2. AAMA 501.2 Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.
3. AAMA 508-07 Voluntary Test Method and Specification for Pressure Equalized Rain Screen Wall Cladding Systems
4. AAMA 2604 Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
5. AAMA 2605 Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American Society of Civil Engineers (ASCE):

1. ASCE 7 Minimum Design Loads for Buildings and Other Structures.

D. National Fire Protection Association (NFPA):

1. NFPA 285 Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components.

2. NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

E. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA):

1. Architectural Sheet Metal Manual.

F. UL:

1. UL 263 Fire Resistance Tests of Building Construction and Materials.
2. UL 723 Test for Surface Burning Characteristics of Building Materials.
3. UL 1040 Fire Test of Insulated Wall Construction.
4. UL 1715 Room Corner Test.

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Shop Drawings:

1. Elevations showing each metal panel and attachment point.
2. Details of each condition of installation and attachment.
3. Details of each transition and termination.

C. Samples:

1. Manufacturers complete range of colors for selection.
2. Three samples of panel in finish selected by Architect.

D. Project Information:

1. Structural calculations for Preformed Metal Wall Panels indicating design conforms to specified design criteria, sealed by the Specialty Structural Engineer.
   a. Submit concurrent with Shop Drawings.
2. Certification of installer qualifications.
3. Field Water Infiltration Test reports.

E. Contract Closeout Information:

1. Warranty.

1.4 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer franchised or approved in writing by manufacturer.

B. Provide Preformed Metal Panels engineered to support dead, live, and lateral, wind or seismic, loads indicated.

1. Include headers and reinforcing members around openings.
2. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.

1.5 NUCORWARRANTY

A. Provide five year warranty on wall panels, flashing and associated work.

B. Warranty to cover waterproof integrity of panel system against leaks through wall.

C. Warranty signed by Contractor and Installer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Preformed Metal Panels:

1. Base:
   a. Varco Pruden
2. Optional:
   a. NuCor
   b. PAC-CLAD
   c. MBCI

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Design Loads:

1. Design Preformed Metal Panels and anchorage to meet design loads.
   a. Wind Loads:
      1) Wind Pressures as required per local building code based on wind speed, exposure factor and importance factor noted in the Structural Drawings.
      2) minimum.
   b. Deflection Values: Use the most restrictive of the following:
      1) Limit deflection to values specified for Uniform Design Load Test.
      2) Limit deflection to comply with Building Code as locally adopted and amended.
      3) Limit deflection to L/175 or maximum.

B. Thermal Expansion and Structural Movement:

1. Expansion and contraction, caused by changes in surface temperature equal to DT (delta T).
   a. Delta T for this project: 200 deg F 93.3.
   b. Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.
   c. Operating windows and doors shall function normally over this temperature range.

C. Structural Movements of Building Structure:

1. Inter-story drift caused by wind or earthquake forces.
   a. h/120 maximum.
2. Live load deflection of the supporting members.
   a. L/180 maximum.
   b.

D. Drainage:

1. Design Preformed Metal Panels to intercept, collect, contain, and drain water which may infiltrate system to exterior.

2.3 MATERIALS

A. Preformed Metal Panels:

1. Use: Vertical Wall Panel.
2. Coverage: 36 inches.
3. Style: RPR by Varco Pruden.
4. Thickness 24 gauge.

5. Color: To be selected from complete standard range of colors.
6. Interior finish:
    a. Prime coat of manufacturer's standard light color.

B. Perimeter Trim, Flashing and Accessories:

1. As required to complete entire wall panel installation.
2. Shop fabricated corners.
3. Match gage, color, and finish of wall panels.

C. Fastening System as approved by Manufacturer to meet Design Criteria.

D. Insulation:

1. Specified in Section 07 21 00

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrate to receive installation.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Erect system, per reviewed shop drawings.

B. Erect with concealed fasteners.

C. Use fasteners which lock entire unit to structural supports and prohibit negative load pull-off under design loads.

3.3 FIELD TESTING

A. Upon completion of walls, perform field water test in accordance with AAMA 501.2 - Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

B. Spray entire surface of exterior walls.

C. Repair leaks.

3.4 PROTECTION

A. Provide required temporary closures and flashings to maintain weather integrity, during and after erection.

END OF SECTION

SECTION 07 61 13
METAL ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vapor retarder.
2. Roof insulation.
3. Ice dam membrane.
4. Standing seam metal roofing.
5. Prefinished gutters and downspouts.
6. Snow retention system.
7. Sheet metal work required for roofing.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 04 05 23 - Masonry Accessories.
2. Section 06 10 00 - Rough Carpentry.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Architectural Manufacturers Association (AAMA):
   a. 621, Voluntary Specifications for High Performance Organic Coatings on Coil Coated Architectural Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.
2. ASTM International (ASTM):
   a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   b. A792/A792M, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
   c. C209, Standard Test Methods for Cellulosic Fiber Insulating Board.
   d. C1289, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
   e. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
   f. D1970/D1970M, Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
   g. D4833/D4833M, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
   h. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
   i. E1592, Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.
   j. E1646, Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference.
   k. E1680, Standard Test Method for Rate of Air Leakage Through Exterior Metal Roof Panel Systems.
   l. E1745, Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
   m. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
3. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):

a. Architectural Sheet Metal Manual.

4. Underwriters Laboratories, Inc. (UL):
   a. Building Materials Directory.
   b. Fire Resistance Directory.
   c. 580, Standard for Tests for Uplift Resistance of Roof Assemblies.
   d. 790, Standard Test Methods for Fire Tests of Roof Coverings.
   e. 1256, Standard for Fire Test of Roof Deck Constructions.

B. Qualifications:

1. Manufacturer shall have minimum of 10 years of experience in the production of structural standing seam metal roofing.
   a. All structural components of the roof system shall be designed and sealed by registered professional structural engineer licensed in the State of Iowa.
2. Installing contractor shall be licensed or approved in writing by manufacturer.
3. Contractor and installer shall have minimum of seven years of experience in the installation of structural standing seam metal roof systems similar to system specified.
4. Contractor and installer shall have successfully completed two projects of similar size, scope and complexity within past two years.
5. Panels shall be same panels as specified or approved for Project.
   a. Exact color is not necessary; however, Contractor is to label each exposed component to identify final installed color of component.
6. Step construction to allow observation of all components.
7. Construct additional mock-ups or rework existing mock-ups until acceptable to Engineer.
8. Maintain mock-ups at project site until Engineer approves removal of mock-ups.
9. Approved mock-ups to constitute minimum acceptable standard of quality for actual construction.

C. Completed roof system to be inspected by roof manufacturer's authorized factory trained representative prior to issuance of roof warranty.

1.3 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Steep Slope: Having a pitch of 3:12 or greater.

C. Low Slope: Having a pitch less than 3:12 but greater than 1/4:12.

D. PVDF: Polyvinylidene fluoride.

1.4 SYSTEM DESCRIPTION

A. Prefinished, field-insulated, structural standing seam metal roof system, including but not limited to:

1. Ice dam membrane.
2. Vapor retarder.
3. Structural standing seam metal roof panels.
   a. Roof panel support and attachment system to be determined by standing seam roof manufacturer.

B. All flashing and miscellaneous trim required for a complete water and airtight system, including but not limited to:

1. Flashing.
2. Counterflashing.
3. Sealants.

C. Standing seam fascia system.

D. Prefinished gutters and downspouts.

E. Snow retention system.

1.5 SUBMITTALS

A. Shop Drawings:

1. Fabrication and/or layout drawings:
   a. Manufacturer prepared computer generated Drawings showing anchorage, flashing, jointing and all other accessories required and all special detailing required by the system.
      1) Minimum plan scale: 1 inch = 8 feet.
      2) Minimum detail scale: 1-1/2 inches = 1 foot.
   b. Provide complete erection plan for each building structure with all details and sections referenced, all penetrations shown, expansion joints shown, detailed and referenced, and all special conditions identified, referenced and detailed.
   c. Erection plan to identify limits of each different substrate material (decking).
   d. Provide distinction between factory and field assembled work.
2. Product technical data including:
   a. Manufacturer data sheets on each component, including masonry reglets used in the roof system.
   b. Acknowledgement that products submitted meet requirements of standards referenced.
      1) Certification by manufacturer that roofing assembly being supplied has been successfully tested under UL 580 procedures and has achieved a Class 90 rating.
3. Test results:
   a. UL 580, Class 90 test data.
   b. ASTM E1592 test results.
      1) Provide results of tests conducted in accordance with ASTM E1592 for panel size and gage and clip type and spacing similar to panels and clips being used.
   c. ASTM E1646 and ASTM E1680 test results.
   d. Concentrated load test data.
      1) Load test to be conducted on panel size, gage and with clip spacing as required.
4. Qualifications:
   a. Manufacturer: Provide structural engineer qualifications.
   b. Contractor:
      1) Certification of approval or license to install product from manufacturer.
      2) Certification of experience.
      3) Listing of projects completed in the past two years with similar scope.
      4) Completed projects information to include, square footage of roofing installed, dollar value of roofing installed, manufacturer and type of roofing installed and contact name and telephone number of building Owner.
   c. Installer: Provide qualifications of all personnel expected to be working on the Project.
5. Roofing manufacturer's letter of approval for insulation proposed for use.
6. Warranty: Sample language of manufacturer's warranty to be provided on this Project.
7. Structural Engineer's sealed and signed calculations certifying that system structural components meet the requirements for lateral, upward and downward loads specified.

B. Samples:

1. General: Tag, identify and provide statement regarding use for all fasteners, anchor clips, closures and sealants.
2. Color samples:
    a. For initial preliminary color selection, provide manufacturer's color chart showing all colors available.
    b. For final color selection, provide two 2 inches x 3 inches colored metal samples, for each color selected during the initial color selection.

C. Contract Closeout Information:

1. Operation and Maintenance Data:
    a. See Specification Section 01 77 01 for requirements of project closeout.

D. Informational Submittals:

1. Final warranty.

1.6 WARRANTY

A. Provide 20 year complete system warranty, including material for air and weather tightness of entire roof assembly signed by manufacturer.

1. Warranty limits shall meet the minimum load capacity requirements of ASTM E1592.

B. Provide manufacturer's 20 year warranty on panel finish against fading, chipping, cracking and peeling of the panel exterior finish and/or erosion of substrate metal.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Metal roofing and standing seam fascia products specified are manufactured by Centria.

B. Manufacturers listed and other manufacturers not listed, but capable of meeting this Specification Section, are expected to provide a system with similar profile, standing seam height, spacing, construction and factory applied finish.

C. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Metal roofing :
    a. CENTRIA by NCI Building Systems.
    b. Merchant & Evans, Inc. - ZIP-RIB.
    c. IMETCO.
    d. Other manufacturers capable of providing structural standing seam system and profiles similar to that specified will be considered.
2. Vapor retarder:
    a. Griffolyn by Reef Industries, Inc.
3. Ice dam membrane.
    a. GAF.
    b. Carlisle Coatings & Waterproofing.
    c. Owens Corning.
4. Insulation:
    a. Any manufacturer meeting these specifications and approved by metal roofing manufacturer.
5. PVDF resin:
    a. PPG IdeaScapes - DURANAR.

b. Valspar - Fluropon.
c. Arkema - Kynar 500.
d. Solvay - Hylar 5000.
e. Solvay - Hylar 5000.

6. Snow retention system:
   a. S-5! Attachment Solutions by Metal Roof Innovations, Ltd.
   b. Provide at 12” from edge with gutter.

2.2 MATERIALS

A. Roof Panels:

1. General:
   a. Galvalume steel, ASTM A792/A792M, Class SS, Grade 50B.
      1) Painted surfaces: AZ50.
      2) Unpainted surfaces: AZ55.

B. Perimeter Trim, Panel Closures, Flashing and Counterflashing: Material and factory applied finish to match roof panels.

C. Fasteners: 300 series stainless steel, ASTM F593.

D. Intermediate Support System:

1. Galvanized steel: ASTM A653/A653M, Class SS, Grade 50, G90.

E. Sealant: Manufacturer's standard non-curing butyl.

F. Ice dam membrane.

1. Self-adhesive, polymer modified bituminous sheet.
2. Thickness: Minimum 40 mil.
3. Manufactured to meet ASTM D1970/D1970M.
4. Non-slip surface.
5. Acceptable to roofing manufacturer.

G. Masonry Reglets: See Specification Section 04 05 23.

2.3 ACCESSORIES

A. Gutters and Downspouts:

1. General:
   a. Galvalume steel, ASTM A792/A792M, Class CS.
      1) Painted surfaces: AZ50.
      2) Unpainted surfaces: AZ55.
      3) Minimum thickness: 22 GA.
      4) All exposed surfaces to have finish and color to match roofing metal.
2. Gutters:
   a. "Style D" gutter per SMACNA Figure 1-2.
      1) Seamless except for expansion joints.
   b. Gutter straps and eave closure flashing: Match gutter material, finish and color.
3. Downspouts:
   a. SMACNA Figure 1-32B.
      1) Seam on concealed side of downspout.
      2) Provide gutter to downspout connection per SMACNA Figure 1-33B, Detail 1.
   b. Hanger straps: Material and finish to match downspouts.

B. Vapor Retarder:

1. ASTM E1745, Class A rated.
2. Water vapor permeance: ASTM E96/E96M, 0.03 maximum.
3. Tensile strength: ASTM D882, 275 feet-LB.
4. Puncture strength: ASTM D4833/D4833M, 72 feet-LB.
5. Griffolyn Type 105.
6. Vapor retarder tape: As recommended by vapor retarder manufacturer.

C. Roof Penetration Flashing:

1. Round penetrations:
   a. Premolded EPDM boot with metal collar.
   b. Buildex "DEK-TITE."

D. Flashing Curb:

1. Provided by metal roofing manufacturer.
2. One-piece completely seal welded prefabricated roof curb, including vertical flashing, and counter flashing, cricket on high side of penetration and flat pan fabricated to replace standing seam metal roof panel.
3. Size as required for penetration.
4. Bottom sloped to match roof.
   a. Level on top.
5. Minimum 16 GA galvannealed steel.
   a. Finish to match roof panel.

E. Foam and metal closures, sealant, gaskets, fasteners, washers, clips, angles, and all miscellaneous trims shall be provided by roofing manufacturer, fabricated for the specific condition as required.

F. Snow Retention System:

1. Mechanical non-penetrating system for sloped metal roof systems to prevent ice and snow from sliding off roof.
   a. Provide splice fittings for a continuous installation.
2. Snow retention system shall consist of aluminum extrusion secured to the standing seam with non-penetrating stainless steel set screws having rounded points.
3. Aluminum:
   a. Finish: Manufacturer's standard finish.
   b. Extrusion to have receptacle in face to provide for insertion of prefinished sheet metal strip to match roofing color.
4. Snow/Ice clips:
   a. Aluminum or stainless steel.
   b. Provide with rubber foot on end that sits on the metal roof pan.
5. Metal Roof Innovations, Ltd. S-5! "ColorGard" system.

2.4 FABRICATION

A. General:

1. Fabricate with square, true corners, mitered and welded.
2. Fabricate trim, flashings and closure pieces to match panel profile and finish.
3. Hem all edges.
4. Fabricate panels in full length with no end laps.

B. Standing Seam Metal Roof Panels:

1. Profile: Centria "SRS" System.
2. Height of standing seam: 2 inches.
3. Gage: Minimum 24.
4. Width:
    a. 12 inches.
    b. Longitudinal stiffening elements to minimize oil canning.
5. System shall be designed as a true structural standing seam shape.
6. Finish:
    a. PVDF based with minimum 70% resin.
    b. Three-coat system having minimum 0.8 mil epoxy primer coat on both sides of panel with a 0.8 mil PVDF resin color coat and a 0.8 mil PVDF resin clear top coat on the exterior side of the panel.
    c. Meet or exceed requirements of AAMA 621.
    d. Smooth finish.
    e. Color:
        1) To be selected from manufacturers full range of primary and secondary colors.
            a) Does not include exotic, metallic flake or iridescent colors.
7. Concealed fasteners:
    a. Provide concealed fasteners in all locations.
    b. If exposed fasteners are required by the roof panel manufacturer, because of location, constructability issues or other critical design requirement, finish of fastener shall match roof panel finish.
        1) Exposed fasteners are to be approved by Engineer.
    c. The use of deflection limiter devices is not allowed.

C. Intermediate Support System:

1. Roof panel anchor clips:
    a. Manufacturer's standard one-piece clip suitable for condition.
        1) Two-piece clips are acceptable if required by roofing manufacturer.
    b. Minimum 16 GA steel.
        1) Galvanized, ASTM A653/A653M, G90.
2. Roof panel manufacturer shall be responsible for designing and providing all necessary intermediate "Z" or "hat-shaped" or other miscellaneous support members as required to transfer roof panel loads into building roof framing members.
    a. Design in accordance with building code and loads shown on the Drawings.
3. Bearing plates:
    a. Sized by roofing manufacturer for roof loading indicated.
    b. Minimum 16 GA steel.
        1) Galvanized, ASTM A653/A653M, G90.

2.5 SOURCE QUALITY CONTROL

A. Roof assembly to be Class A roof covering assembly per UL 1256.

B. Structural Testing:

1. The system shall be designed to safely resist the positive and negative loads per the building code and as shown on Drawings.
2. Structural-uniform uplift load capacity of the panel system shall be determined in accordance with ASTM E1592.
    a. The factor of safety on the test results shall be 1.65 for the panel, batten or clip ultimate loads with no increase for wind.

b. The factor of safety for fasteners shall be 3.0 for one single fastener per clip, 2.25 for two fasteners per clip and 4.0 inches masonry.

c. Design uplift capacity for conditions of gage, span or loading other than those tested may be determined by interpolation of test results.

1) Extrapolation of conditions outside the range of the tests is not acceptable.

d. Deflection shall be L/180 for positive loading.

C. Water Penetration: No uncontrollable leakage at minimum 6.4 psf when tested in accordance with ASTM E1646.

D. Air Infiltration: Maximum 0.00 SCFM/SQFT when tested at 4.0 psf differential pressure when tested in accordance with ASTM E1680.

E. Fire Resistance/Wind Uplift Rating:

1. UL 790, Class 1.
2. UL 580, Class 90.

F. The panels shall withstand a 250 pound concentrated load applied to a 4 square inches area at the center of the panel at mid span between supports with no panel deformation, rib buckling, or panel sidelap separation which will adversely affect the weather tightness of the system.

G. Support roofing panels on top of roof insulation using bearing plates attached to the structural frame or connect to manufacturer-provided intermediate support system.

1. Bearing plate and standing seam roof panel anchor clip attachment is to be determined by the roofing manufacturer and shall take precedent over this Specification.
   a. Provide attachment to roof structural frame or deck as required for loading criteria specified.
2. Roof panel anchor clips shall be designed to allow thermal movement of the panels except where specific fixed points are indicated.
   a. Roof panel manufacturer shall be responsible for determining fixed point locations unless otherwise indicated.
3. Wood blocking shown at roof edge is strictly for attachment of miscellaneous flashings and shall not be used for any structural value.
4. Maximum spacing of roof clips shall be determined by manufacturer.

H. Roof panel manufacturer shall be responsible for designing and installing all necessary expansion joints in the roof system.

1. Where roof expansion joints occur, provide corresponding expansion joints in fascia, soffit and gutters.

2.6 MAINTENANCE MATERIALS

A. Provide Owner with 4 OZ of touch-up paint to match each different color used in the system.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions, SMACNA (where referenced) and details shown on Drawings for a complete weathertight installation without waves, warps buckles or distortions.
   a. Provide all closures, trim, angles, plates, sealant, gaskets, fasteners, washers, etc., as necessary.
2. Attachments shall allow for thermal expansion and contraction.
3. Seal all joints as required for watertight installation.
4. Touch-up paint all damaged surfaces.

B. Vapor Retarder:

1. Install on winter warm side of roof assembly in accordance with manufacturer's recommendations.
2. Lap joints minimum: 4 inches.
3. Seal to perimeter, tape all joints and repair all tears.

C. Roof Insulation:

1. Install in accordance with manufacturer’s recommendations.
2. If multiple layers are provided to achieve total thickness as shown on Drawings, stagger joints minimum 12 inches in each direction.

D. Ice Dam Membrane:

1. Install per manufacturer's recommendations in areas indicated on Drawings.
2. Provide ice dam membrane from eave line to a point that is a minimum of 36 inches horizontally inside the interior face of the exterior wall.
3. Provide at all ridges, hip ridges and hip valley lines extending minimum 36 inches up the slope at valleys and down the roof slope each side of the ridge line.

E. Standing Seam Roofing Panels:

1. Install in one continuous length from ridge to eave.
2. Hand crimp battens at each clip.
3. Seam panels and battens together with portable electric seaming machine supplied by the manufacturer.

F. Snow Retention System:

1. Install starting 2 feet from the eave edge of the roof.
2. Install system in continuous lengths using manufacturer provided splice fittings.
3. Mount to metal roofing utilizing clamps fastened to standing seam with non-penetrating bullet-nosed set-screws.
    a. Fasteners shall be compatible with roof panel system and shall not void any roof warranties.
    b. Fasteners shall not damage panel finish.
4. Install metal color strip in face of extrusion.
    a. Color strip to match color of standing seam roofing.
5. Provide snow/ice clips in each standing seam panel laterally across the roof or as recommended by manufacturer.
    a. Provide single clip for seam spacing of less than 16 inches and two clips for seam spacing 16 inches and greater.

G. Gutters:

1. Install gutters using gutter straps in accordance with SMACNA Table 1-8 and Figure 1-12 and per roofing manufacturer's recommendations.
    a. Provide gutter brackets or hangers at 24 inches on-center maximum.
    b. Provide expansion joints in gutters per SMACNA and at expansion joint locations shown on Drawings.
    c. Install gutters to provide positive drainage to downspout locations.
    d. Seal all joints in gutters to provide completely water tight system.

H. Downspouts:

1. Install downspouts in locations shown on the Drawings.
2. Provide downspout hanger straps per SMACNA Figure 1-35 as appropriate for downspout style.

3. Provide gutter to downspout connection per SMACNA Figure 1-33B, Detail 1.
4. Seal all joints in downspout for a complete watertight system.
   a. Angle bottom of downspout out away from building.
5. Fasten hanger straps to building wall with stainless steel screws and anchor sleeves appropriate for wall construction.
   a. Provide minimum of two fasteners per strap.
6. Maximum spacing of hanger straps shall be 10 feet with minimum of two hanger straps per vertical piece of downspout.
7. Spacing and location of hanger straps shall be consistent from downspout to downspout.

END OF SECTION

SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Architectural flashing and sheet metal work.
2. Prefinished scuppers, conductor heads and downspouts.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 04 05 23 - Masonry Accessories.
2. Section 07 61 13 - Metal Roofing.
3. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Architectural Manufacturers Association (AAMA):
   a. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
2. American National Standards Institute/Single Ply Roofing Industry (ANSI/SPRI):
   a. ES-1, Wind Design Standard for Edge Systems Used with Low Slope Roof Systems.
3. ASTM International (ASTM):
   a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
   b. A666, Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   c. B32, Standard Specification for Solder Metal.
   d. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
4. FM Global (FM).
5. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   a. Architectural Sheet Metal Manual.

B. Qualifications:

1. Sheet metal fabricator shall have minimum 10 years experience in fabrication of sheet metal items similar to items specified.
2. Sheet metal installer shall have minimum five years experience installing sheet metal items specified.

1.3 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. PVDF: Polyvinylidene fluoride.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
2. Fabrication and/or layout drawings.
    a. Scaled drawing showing expansion joint locations, special conditions, profile, fastening and jointing details.
        1) Minimum plan scale: 1/8 inches = 1 foot.
        2) Minimum detail scale: 1-1/2 inches = 1 foot.
3. Fabricator qualifications.
4. Installer qualifications.

B. Samples:

1. Finish and color samples for each product specified for Engineer preliminary color selection.

C. Informational Submittals:

1. Warranty: Manufacturer's sample warranty language.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Pre-finished sheet metal:
    a. Carlisle SynTec Systems.
    b. Holcim Elevate.
    c. Petersen Aluminum Corporation.
2. Butyl sealant:
    a. Pecora Corporation.
    b. Sika.
    c. Tremco Commercial Sealants & Waterproofing.

2.2 MATERIALS

A. Sheet Metal:

1. Galvalume Steel: ASTM A792/A792M.

B. Fasteners: Non-ferrous compatible with sheet metal.

C. Sealants:

1. Non-curing Butyl Sealant:
    a. Pecora "BA-98".
    b. Sika "SikaLastomer 511".
    c. Tremco "TremPro JS-773".
2. Building sealants:
    a. See Specification Section 07 92 00.

D. Fasteners: Non-ferrous compatible with sheet metal.

E. Retainer Clips and Continuous Cleats: Galvanized steel or stainless steel.

F. Solder: ASTM B32.

G. Dissimilar Metal Protection: Comply with Specification Section 09 91 10.

H. Reglets: See Specification Section 04 05 23.

2.3 FABRICATED ITEMS

A. General:

1. Shop fabricate items to maximum extent possible.
    a. Fabricate true and sharp to profiles and sizes indicated on Drawings.
        1) Shop fabricate and weld or solder all corners.
2. Pre-finished steel:
    a. Galvanized, G-60 or Galvalume, AZ-55.
    b. Thickness: Minimum 24 GA.
    c. Texture: Smooth.
    d. Coated on exposed face with PVDF coating having a minimum 70% resin content and a minimum 1.0 mil dry film thickness.
        1) Meet requirements of AAMA 2605.
        2) Color: From Manufacturer's available standard colors.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide items to be built into other construction to Contractor in time to allow their installation.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions, SMACNA, and as indicated on Drawings.

B. Weld aluminum to achieve weathertight joints and required details.

1. Do not weld slip joints.
2. Touch-up damaged prefinished items.

C. Set top edges of membrane flashing and sheet metal flashing into reglets wherever practicable.

1. Surface applied terminations will be allowed only where specifically detailed or otherwise approved in writing by the Engineer.
2. Provide counterflashing at all reglets.
3. Seal reglets and counterflashings in accordance with Specification Section 07 92 00.

D. Fasten materials at intervals recommended by SMACNA.

E. Install slip joints to allow for thermal movement as recommended by SMACNA and manufacturer.

1. Maximum spacing: 10 feet on-center.
2. Provide slip joint 24 inches from corners.
3. Provide slip joint at each vertical expansion joint location in wall.
    a. Provide break in continuous cleat at each vertical expansion joint.
    b. The above expansion joints do not include brick veneer expansion joints.

F. Seal slip joints with two beads of non-curing butyl sealant on each side of slip joint overlap.

G. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.

H. Provide dissimilar metals and materials protection where dissimilar metals come in contact or where sheet metal contacts mortar, concrete masonry or concrete.

I. Provide all miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.

1. Provide all components necessary to create weather-tight junctures between roofing and sheet metal work.

J. Installation of Gutters:

1. Install gutters using gutter straps in accordance with SMACNA Table 1-8 (built-in gutters) and Figure 1-12 through 1-20 (hanging gutters).
    a. Provide gutter brackets or hangers at 24 inches on-center maximum.
    b. Provide expansion joints in gutters per SMACNA Figure 1-5.
    c. Install gutters to provide positive drainage to downspout locations.
    d. Seal all joints in gutters to provide completely water tight system.
    e. Provide 1/4 inches x 1/4 inches aluminum mesh debris screen continuous on top of gutter.
        1) Screen shall be mounted in aluminum frame which will allow replacement of screen without damage to gutter, screen or screen frame.

K. Installation of Downspouts:

1. Install downspouts in locations shown on the Drawings.
2. Provide downspout anchor straps per SMACNA Figure 1-35 as appropriate for downspout style.
3. Provide gutter to downspout connection per SMACNA Figure 1-33B, Detail 1.
4. Seal all joints in downspout for a complete watertight system.
5. Angle bottom of downspout out away from building to direct discharge onto concrete splashblock.
6. Anchor hanger straps to building wall with stainless steel screws and anchor sleeves appropriate for wall construction.
    a. Provide minimum of two anchors per strap.
7. Maximum spacing of hanger straps shall be 10 feet with minimum of two hanger straps per vertical piece of downspout.
8. Spacing and location of hanger straps shall be consistent from downspout to downspout.

END OF SECTION

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sealing all joints which will permit penetration of dust, air or moisture.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Concrete Institute (ACI):
   a. 302.1R, Guide for Concrete Floor and Slab Construction.
2. ASTM International (ASTM):
   a. C834, Standard Specification for Latex Sealants.
   b. C920, Standard Specification for Elastomeric Joint Sealants.
   c. C1521, Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints.
3. NSF International (NSF):
   a. 61, Drinking Water System Components -- Health Effects.
4. Underwriters Laboratories, Inc. (UL).

B. Qualifications: Sealant applicator shall have minimum five years experience using products specified on projects with similar scope.

1.3 DEFINITIONS

A. Defect(ive): Failure of watertightness or airtightness.

B. Finish sealant: Sealant material per this specification applied over face of compressible sealant or expanding foam sealant specified, to provide a finished, colored sealant joint.

C. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

D. "Interior wet areas": Toilets and similar areas.

E. "Seal," "sealing" and "sealant": Joint sealant work.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Manufacturer's recommendations for joint cleaner, primer, backer rod, tooling and bond breaker.
2. Certification from sealant manufacturer stating product being used is recommended for and is best suited for joint in which it is being applied.
3. Certification of applicator qualification.

B. Test Results:

1. Provide adhesion test results for each sealant sample including adhesion results compared to adhesion requirements.
2. Manufacturer's authorized factory representative recommended remedial measures for all failing tests.

C. Samples:

1. Cured sample of each color for Engineer's color selection.
2. Color chart not acceptable.

D. Informational Submittals:

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original unopened containers with labels intact: Labels shall indicate contents and expiration date on material.

1.6 PROJECT CONDITIONS

A. Schedule installation of sealant work after completion of penetrating item installation but prior to covering or concealing of openings.

B. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

C. Do not proceed with the installation of sealant materials when the ambient temperature is outside the manufacturer’s recommended limitations for installation and curing times as printed on the product label and product data sheet.

D. During installation provide masking and drop cloths to prevent sealant materials from contaminating any adjacent surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Compressible sealant:
   a. Schul International Company, LLC.
   b. Emseal by Sika.
   c. Norton.
   d. Sandell Moisture Protection Systems.
2. Expanding foam sealant:
   a. M-D Building Products, Inc.
   b. DAP Products, Inc.
   c. FAI International, Inc.
   d. Power Fasteners.
3. Polyether sealants:
   a. Master Builders Solutions.
   b. Chem Link.
   c. Tremco Commercial Sealants & Waterproofing.
4. Polysulfide rubber sealant:
   a. Pecora Corporation.
   b. Master Builders Solutions.
   c. PolySpec by ITW Polymers Sealants.
5. Polyurea joint filler:

a. Dayton Superior Corporation.
b. Euclid Chemical Company.
c. L&M by LATICRETE International, Inc.
d. Master Builders Solutions.

6. Polyurethane sealants:
   a. Pecora Corporation.
   b. Sika.
   c. Master Builders Solutions.
   d. Tremco Commercial Sealants & Waterproofing.
7. Silicone sealants:
   a. Chem Link.
   b. GE Silicones.
   c. Dow.
   d. Tremco Commercial Sealants & Waterproofing.
8. Backer rod, compressible filler, primer, joint cleaners, bond breaker:
   a. As recommended by sealant manufacturer.

2.2 MATERIALS

A. Sealants - General:

1. Provide colors matching materials being sealed.
2. Where compound is not exposed to view in finished work, provide manufacturer's color which has best performance.
3. Nonsagging sealant for vertical and overhead horizontal joints.
4. Sealants for horizontal joints: Self-leveling pedestrian/traffic grade.
5. Joint cleaner, primer, bond breaker: As recommended by sealant manufacturer.
6. Sealant backer rod and/or compressible filler:
   a. Closed cell polyethylene, polyethylene jacketed polyurethane foam, or other flexible, nonabsorbent, non-bituminous material recommended by sealant manufacturer to:
      1) Control joint depth.
      2) Break bond of sealant at bottom of joint.
      3) Provide proper shape of sealant bead.
      4) Serve as expansion joint filler.

B. Compressible Sealant:

1. Foamed polyurethane strip saturated with polymerized polybutylene waterproofing coated on front face with nonreactive release agent that will act as bond breaker for applied sealant.
   a. Schul "Sealtite B".
2. Adhesive: As recommended by sealant manufacturer.

C. Expanding Foam Sealant:

1. One or two component moisture cured expanding urethane.
2. Shall not contain formaldehyde.
3. Density: Minimum 1.5 pcf.
4. Closed cell content: Minimum 70%.
5. R-value: Minimum 5.0/IN.
6. Flame spread: Less than 25.
7. Smoke developed: Less than 25.

D. Polyether Sealant:

1. Silyl-terminated polyether polymer.
2. ASTM C920, Type S, Grade NS, Class 50, Use NT, M, A, and O.
    a. Master Builders Solutions MasterSeal 150.
    b. Chem Link DuraLink.
    c. Tremco Dymonic FC.

E. Polysulfide Rubber Sealant:

1. One or two component.
2. Meet ASTM C920.
    a. Pecora Synthacalk GC2+.
    b. PolySpec THIOKOL 2235.

F. Polyurea Joint Filler:

1. Two component, semi-rigid material for filling formed or saw-cut control joints in interior concrete slabs.
    a. Dayton Superior Corporation "Joint Fill, Joint Seal, Joint Saver II" as required for condition and recommended by manufacturer.
    b. Euclid Chemical Company "EUCO QWIK" joint.
    c. L&M "Joint Tite 750".
    d. Master Builders Solutions MasterSeal “CR100" control joint filler.
2. Comply with ACI 302.1R performance recommendations regarding control and construction joints.
3. Color: Gray.

G. Polyurethane Sealant:

1. One or two components.
2. Paintable.
3. Meet ASTM C920 Type S or Type M, Grade NS or P, Class 25, Use NT, T, M, A and O.
    a. Pecora Dynatrol-IXL, Dynatrol II, Urexpan NR-200, NR-201.
    b. Sika Chemical Corporation Sikaflex-1a, Sikaflex-2C NS/SL.
    c. Master Builders Solutions MasterSeal NP-1, NP-II, SL-1 SL-2.
    d. Tremco Dymonic or Dymeric, Vulkem 116,227,45,245.

H. Silicone Sealant:

1. One component.
2. Meet ASTM C920, Type S, Grade NS, Class 25, Use NT, G, A, O.
    a. Chem Link DuraSil.
    b. GE Silpruf, Silglaze II.
    c. GE Sanitary 1700 sealant for sealing around plumbing fixtures.
    d. Dow 786 for sealing around plumbing fixtures.
    e. Dow 7565, 790, 791, 795.
    f. Tremco Spectrem 1, Spectrem 3, Tremsil 600.
3. Mildew resistant for sealing around plumbing fixtures.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before use of any sealant, investigate its compatibility with joint surfaces, fillers and other materials in joint system.

B. Use only compatible materials.

C. Where required by manufacturer, prime joint surfaces.

1. Limit application to surfaces to receive sealant.
2. Mask off adjacent surfaces.

D. Provide joint depth for joints receiving polyurea joint filler in accordance with manufacturer's recommendations.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions and UL requirements.

B. Clean all joints.

C. Make all joints water and airtight.

D. At changes in direction of joints, joint intersections and where sealant joints interface with other construction, install continuous sealant as necessary to ensure a weather-tight seal.

E. Make depth of sealing compounds, except expanding foam and polyurea sealant, not more than one-half width of joint, but in no case less than 1/4 inches nor more than 1/2 inches unless recommended otherwise by the manufacturer.

F. Provide correctly sized backer rod, compressible filler or compressible sealant in all joints to depth recommended by manufacturer:

1. Take care to not puncture backer rod and compressible filler.
2. Provide joint backer rod as recommended by the manufacturer for polyurea joint filler.

G. Apply bond breaker where required.

H. Tool sealants using sufficient pressure to fill all voids.

I. Upon completion, leave sealant with smooth, even, neat finish.

J. Where piping, conduit, ductwork, etc., penetrate wall, seal each side of wall opening.

K. Install compressible sealant to position at indicated depth.

1. Size so that width of material is twice joint width.
2. Take care to avoid contamination of sides of joint.
3. Protect side walls of joint (to depth of finish sealant).
4. Install with adhesive faces in contact with joint sides.
5. Install finish sealant where indicated.

L. Install expanding foam sealant to minimum 4 inches depth or thickness of wall being penetrated if less than 4 inches or as indicated on Drawings.

1. Provide adequate backing material as necessary.
2. Hold material back from exposed face of wall as necessary to allow for installation of backer rod and finish sealant.
    a. Allow expanding foam sealant to completely cure prior to installing backer rod and finish sealant.
3. Trim off excess material flush with surface of the wall if not providing finished sealant.

3.3 SEALANT WORK

A. General:

1. Work includes but is not limited to: Sealing all joints which will permit penetration of dust, air, or moisture.
2. Refer to SCHEDULE for materials to be used.

B. Concrete joints:

1. Flooring joints.
2. Isolation joints.
3. Joints between paving or sidewalks and building.
4. Construction, control and expansion joints.

C. Masonry:

1. Masonry control joints.
2. Brick expansion joints.
3. Cast stone coping and sill head joints.
4. Glass masonry joints.
5. Between masonry and other materials.

D. Flashing, reglets and retainers.

E. Wood siding and trim.

F. Openings:

1. Perimeters of door and window frames, louvers, grilles, etc.
2. Door thresholds shall be set in a full bed of sealant.
3. Glass and glazing: See specification Section 08 81 00.

G. Interior finishes:

1. Perimeter and penetrations of sound insulated walls.
2. Casework and millwork: See Specification Section 06 41 00.
3. Expansion and control joints in tile work.

H. Plumbing fixtures.

I. Penetrations of walls, floors and decks.

J. Other joints where sealant, expanding foam sealant or compressible sealant is indicated.

3.4 FIELD QUALITY CONTROL

A. Adhesion Testing:

1. Perform adhesion tests in accordance with ASTM C1521 per the following criteria:
   a. Water bearing structures: One test per every 1000 linear foot of joint sealed.
   b. Exterior precast concrete wall panels: One test per every 2000 linear foot of joint sealed.
   c. Chemical containment areas: One test per every 1000 linear foot of joint sealed.
   d. Building expansion joints: One test per every 500 linear foot of joint sealed.
   e. All other type of joints except butt glazing joints: One test per every 3000 linear foot of joint sealed.
   f. Manufacturer's authorized factory representative shall recommend, in writing, remedial measures for all failing tests.

3.5 SCHEDULE

A. Furnish sealant as indicated for the following areas:

1. Exterior areas:
   a. Above grade: Polyether.
   b. Below grade: Polyurethane.
2. Interior areas:
   a. Noncorrosive areas:
      1) Wet exposure: Polyether.

a) Toilet rooms, locker rooms, janitor closets or similar areas: Mildew resistant silicone.

2) Dry exposure: Polyether, unless noted otherwise.

a) Sound insulated construction: Acoustical sealant.

b. Sealant exposed to or having the potential of being exposed to concentrated chlorine gas or chlorine liquid: Polysulfide.

c. Casework, countertops and solid surface materials: Silicone.

1) Sinks, fixtures or other areas subject to potential splash, spillage or condensation: Mildew Resistant Silicone.

3. Compressible sealant: Where indicated.

4. Exterior wall penetrations: Expanding urethane foam, with finish sealant.

a. Finish sealant:

1) Exterior side:

a) Above grade: Polyether.

b) Below grade: Polyurethane.

2) Interior side:

a) Noncorrosive area:

(1) Wet exposure: Polyether.

(2) Dry exposure: Polyether, unless noted otherwise.

5. Interior concrete slab formed or saw-cut control joints: Polyurea joint filler.

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DIVISION 08

OPENINGS

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.
7. Division 26 "Electrical" Sections for electrical connections including conduit and wiring for door controls and operators installed on frames with factory installed electrical knock out boxes.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.

12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.

C. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

D. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

E. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.
    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inchspace between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.
    a. Provide 22-gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
    b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
    c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches.
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer’s thermally enhanced QMax core. Where indicated provide doors fabricated as thermal-rated assemblies with a minimum thermal rating of 0.41 BTU/hr-ft2-F.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches.

5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to have the face sheets spot welded and filled full height with an epoxy filler. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches.
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.
2. Curries Company (CU) - QMax Core - 707 Series.

2.4 HOLLOW METAL DOOR AND SHUTTER ASSEMBLIES FOR STORM SHELTERS

A. General: Provide complete tornado or hurricane storm shelter resistant assemblies constructed, test, and listed/labeled to resist the design pressures for components and cladding and missile impact resistance as described in ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

1. Door and shutter systems, tested and complying with ICC 500 (2014/2020) and FEMA P-361 (2015/2021), Design and Construction Guidance for Community Safe Rooms and supported by third party test results.
2. Sheets fabricated on exterior openings from commercial quality hot dipped zinc coated steel complying with ASTM A924 A60. Gauges to be in accordance with manufacturers tested assemblies.
3. Vertical Edges: Vertical edges to have the face sheets joined by a continuous weld extending the full height of the door. Welds are to be ground, filled and dressed smooth. Beveled Lock Edge, 1/8 inch in 2 inches.
4. Top Edge: Reinforce top of doors with a continuous steel channel extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached and welded in place with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
6. Replaceable Glass System: Provide a field replaceable glass system certified to UL10C and ICC 500 2014 and 2020. Glass shall be Vetrotech Ultimax 90, 2-3/16” thick available in 10” x 10” or 4” x 25” sizes fire rated up to 90-minutes with a 227 psf design pressure for hurricane and 284 psf design pressure for tornado openings and a 15 lb. 2 x 4 at 100mph impact resistance.

B. Manufacturers Basis of Design:

1. CECO Door Products (C) - StormPro Series.
2. Curries Company (CU) - StormPro Series.

2.5 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Weatherstripped Frames: Subject to the same compliance standards and requirements as standard hollow metal frames, provide where indicated weatherstripped profiles with 1/8" integral kerf formed into the frame soffit able to receive manufacturer's listed gasket material. Available for use in both masonry and drywall construction, with fire rating up to 3 hours complying with NFPA 105, UL 1784, and ASTM E-283 Test criteria.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch - thick steel sheet.
3. Manufacturers Basis of Design:
    a. Curries Company (CU) – M Series.
    b. Curries Company (CU) – Kerfed Weatherstripped WM Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch - thick steel sheet.
3. Manufacturers Basis of Design:
    a. Curries Company (CU) - C Series.
    b. Curries Company (CU) - M Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 FRAMES FOR STORM SHELTERS

A. General: Subject to the same compliance standards and requirements as standard hollow metal frames, provide complete tornado or hurricane storm shelter resistant assemblies tested and labeled as complying with ICC 500 (2014/2020) and FEMA P-361 (2015/2021) and supported by third party test listings.

1. Fabricate exterior frames from 14 gauge hot dipped zinc coated steel that complying with ASTM designations A924 A60.
2. Manufacturers Basis of Design:
    a. CECO Door Products (C) - StormPro Series.
    b. Curries Company (CU) - StormPro Series.

2.7 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from metallic coated material, not less than 0.042 inchthick, with corrugated or perforated straps not less than 2 incheswide by 10 incheslong; or wire anchors not less than 0.177 inchthick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inchthick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
4. Storm Shelter Anchors: Masonry T-shaped, wire masonry type, or existing opening type anchors as per manufacturers listing or anchor detail sheets including welded installation methods.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from metallic coated material, not less than 0.042 inchesthick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.9 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-

performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Electrical Raceways: Provide hollow metal doors to receive electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through-wire transfer hardware or wiring harness specified in hardware sets in Division 08 Sections "Door Hardware" and "Access Control Hardware". Wire nut connections are not acceptable.

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Masonry Type: Locate anchors not more than 18 inchesfrom top and bottom of frame. Space anchors not more than 32 inches on-center and as follows:
        1) Two anchors per jamb up to 60 incheshigh.
        2) Three anchors per jamb from 60 to 90 incheshigh.
        3) Four anchors per jamb from 90 to 120 incheshigh.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inchesor fraction thereof above 120 inches high.
    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
        1) Three anchors per jamb up to 60 incheshigh.
        2) Four anchors per jamb from 60 to 90 incheshigh.
        3) Five anchors per jamb from 90 to 96 incheshigh.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inchesor fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 incheswide and mounted in metal stud partitions.

10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:
   a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
   b. Between Edges of Pairs of Doors: 1/8 inchplus or minus 1/16 inch.
   c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
   d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Factory finished flush wood doors.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 08 11 13 – Hollow Metal Doors and Frames.
2. Section 08 71 00 - Finish Hardware.
3. Section 08 81 00 - Glass and Glazing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI):
   a. A208.1, Particleboard.
2. ASTM International (ASTM):
3. Architectural Woodwork Institute (AWI):
   a. Quality Standards:
      1) Section 1500, Factory Finishing.
4. National Fire Protection Association (NFPA):
   a. 80, Standard for Fire Doors and Other Opening Protectives.
   b. 252, Standard Methods of Fire Tests of Door Assemblies.
5. Window and Door Manufacturers Association (WDMA):
   a. I.S. 1A, Interior Architectural Wood Flush Doors.

B. Qualifications:

1. Door manufacturer must have minimum 10 years of experience in manufacturing of wood veneer doors.
2. Manufacturer shall be current member of AWI.

C. All doors to be provided by same manufacturer.

D. All doors to be fabricated using Hot Press 5 Ply construction.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. For fire-rated doors provide all associated fire test information.
   d. Schedule of doors using same reference numbers as indicated on Drawings.
      1) Schedule shall include size, type, swing, rating, frame type and size, and hardware set required.
   e. Available wood species.

B. Samples:

1. Provide actual samples of each factory applied finish for initial finish selection.

2. After initial finish selection, provide two, 12 inches x 12 inches samples showing door construction in veneer and finish selected.
    a. Provide two, 12 inches by 12 inches samples of fire-rated door construction in any veneer type.
        1) Samples are to show interior door construction including core, blocking and edge treatment.

C. Informational Submittals:

1. Certification of AWI membership.
2. Warranty.

1.4 DELIVERY STORAGE AND HANDLING

A. Store and protect doors in accordance with manufacturer's recommendations and WDMA.

1.5 WARRANTY

A. Warrant doors in writing for life of installation against defects including:

1. Veneer delamination.
2. Bow or twist of 1/4 inches or more.
3. Telegraphing of any part of core through face veneer.
4. Surface variation exceeding 1/100 inches in 3 inches span.
5. Any other defect which may impair or affect performance of door for purpose for which it is intended.

B. Warranty to include:

1. Removal and replacement of defective door(s).
2. Removal of existing hardware and refitting to new door.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Doors specified are based on products manufactured by Algoma Hardwoods, Inc.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Flush wood door:
    a. Masonite International Corporation.
    b. Eggers Industries.
    c. VT Industries, Inc.

2.2 MATERIALS

A. Face Veneer:

1. Red oak plain sliced, both faces.
2. Minimum thickness: 0.020 inches at 12% moisture content.
3. All faces to be per WDMA I.S. 1A face grades

B. Core:

1. Non-fire-rated doors:
    a. Solid particle core (PC-5), ANSI A208.1.
    b. Grade: LD-2.
    c. Density: 30-35 pounds/CUFT.
    d. Provide solid wood reinforcing at all hardware locations and around all cut-outs.

C. Hardwood Edges:

1. Match face veneer species.
2. Fire retardant treated in labeled doors.

D. Adhesives:

1. Type 1 water resistant glue.

2.3 FABRICATION

A. General:

1. All doors shall be fabricated in accordance with and shall meet requirements of WDMA I.S. 1A Custom Grade standards.
2. Hardware preparation:
   a. Factory machine doors for application of hardware specified.
   b. Bevel vertical edges 1/8 inches in 2 inches.
   c. Clearance at bottom of door: 1/2 inches.
   d. Clearance at top of door: 1/8 inches.
   e. Tolerances:
      1) Width: +1/32 inches.
      2) Height: +1/16 inches.
      3) Thickness: +1/16 inches.
      4) Hardware location: +1/32 inches.
      5) Locks and hinges: +1/32 inches.
   f. Fit fire rated doors to meet requirements of labeling agency.
   g. Refer to Specification Section 08 71 00 for hardware requirements and template provided by hardware manufacturer.
3. Cut-outs.
   a. Make all cut-outs in the factory.
   b. Seal edges of all openings.
4. All doors shall be 1-3/4 inches thick unless indicated otherwise.

B. "Hot Press" bond hardwood veneer cross-banding to core using Type II glue.

C. Identify doors for proper location.

2.4 SOURCE QUALITY CONTROL

A. Inspect finished door units at factory and repair damage in accordance with AWI.

PART 3 - EXECUTION

3.1 PREPARATION

A. Correct defects or conditions which may interfere with or prevent a satisfactory installation.

B. Condition doors to prevailing humidity for minimum 72 hours prior to handling.

3.2 INSTALLATION

A. Condition doors to prevailing climactic conditions for 72 hours prior to installation.

B. Install doors in hollow metal frames in accordance with manufacturer's instructions and WDMA I.S. 1A.

1. See Specification Section 08 11 13 for door frames.

C. Fit doors to frames and machine for hardware to whatever extent not previously worked at factory.

D. Install fire-rated doors in accordance with NFPA 80.

3.3 FIELD QUALITY CONTROL

A. Remove and replace defective units.

B. Repair damage to finish in accordance with AWI recommendations.

C. Remove and replace damaged doors that are not capable of being satisfactorily repaired.

1. Engineer to make final decision on acceptance of finish repair.

3.4 ADJUSTMENT

A. Prior to Project startup, make final adjustments to doors.

END OF SECTION

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum windows.

B. Related Sections include but are not necessarily limited to:

1. Section 07 92 00 - Joint Sealants.
2. Section 08 81 00 - Glass and Glazing.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Architectural Manufacturers Association (AAMA):
   a. 904, Voluntary Specification for Multi-Bar Hinges in Window Applications
   b. 1503, Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.
   c. 2605, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
2. ASTM International (ASTM):
   a. A924, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   b. C1363, Standard Test Method for the Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
   c. E283, Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   d. E330, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights, and Curtain Walls by Uniform Static Air Pressure Difference.
   e. E331, Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
3. American Welding Society (AWS):
   a. D1.2, Structural Welding Code - Aluminum.

1.3 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data for framing system and major accessories including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Hardware being provided by window manufacturer.
   c. Glass being provided by window manufacturer in factory glazed units.
   d. Manufacturer's installation instructions.

2. Elevation drawings indicating window dimensions and details.

B. Samples:

1. After initial color selection, provide 2 x 3 inches minimum sample of each color and finish selected.

C. Informational Submittals:

1. Qualifications of testing laboratory.
2. Test results.
3. Warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store units in vertical position off ground with wood spacers between each unit.

1.6 WARRANTY

A. Five year warranty of weathertightness of installation.

1. Air and water integrity and structural adequacy of units and hardware, including sealants and sealing within and around perimeter of installation.
2. Signed jointly by fabricator, installer, and contractor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Thermally broken windows:
   a. Wausau Metals Corp., 2250-T Series.
   b. Kawneer Company Inc., 8225-T Series.
2. Storm windows (type E):
   a. Winco 3350 series, 3 ½" thermally broken fixed FEMA 361/ICC 500-2014 heavy commercial aluminum window.
      1) Clear anodized finish.
      2) Factory installed insulated glass for large missile impact.
3. Transaction Window (C):
   a. QuikServ T1 ticket window, custom sized per drawings.
      1) Options:
         a) Speak-thru feature
         b) Ticket slider window

2.2 MATERIALS

A. Extruded Aluminum: 6063T5 alloy.

B. Sealants: As specified in Section 07 92 00.

C. Thermal Insulator: Poured in place polyurethane, self-adhering to adjacent aluminum surfaces.

D. Weatherstripping: Sponge neoprene.

2.3 ACCESSORIES

A. Screens:

1. 18 x 16 mesh aluminum wire screens.
2. Secure to aluminum shapes with vinyl spline.
3. Hold in place with spring loaded plungers.

4. Removable to inside of building.
5. Finish same as window frames.

B. Flashing:

1. Minimum 0.040 inches aluminum.
2. Finish to match window frames.
3. Mill finish if concealed.

2.4 FABRICATION

A. General:

1. Fully degrease and clean members prior to assembly or application of protective coatings.
2. Weld by methods recommended by manufacturer and AWS D1.2 to avoid discoloration at welds.
3. Grind exposed welds smooth and restore finish.
4. Ease corners of cut edges to a radius of approximately 1/64 inches.
5. Conceal fasteners wherever possible.
6. Fit and assemble work at shop to maximum extent possible.
7. Maintain true continuity of line and accurate relation of planes and angles.
8. Provide secure attachment and support at mechanical joint, with hairline fit of contacting members.
9. Reinforce work as necessary to withstand wind loadings and to support system.
10. Separate dissimilar metal with paint or preformed separators to prevent corrosion.
11. Separate metal surfaces at moving joints with plastic inserts or other nonabrasive concealed inserts to permanently prevent freeze-up of joint.
12. Reinforce frames for hardware.
13. Structural steel reinforcement hot-dip galvanized after fabrication meeting G-90, ASTM A924, requirements.

B. Thermal Insulator: Provide minimum 1/4 inches separation between exterior and interior metal surfaces after bridge is removed.

C. Weatherstripping:

1. Thermally broken type windows:
   a. Casement and projected:
      1) Provide two rows of fin type extruded neoprene weatherstrips extending around perimeter of sash at both inner and outer overlap contacts.
      2) Provide corners which are securely staked and joined.
      3) Provide units which are easily replaceable.

D. Window Hardware:

1. General:
   a. Locking device and strikes: White bronze and/or non-magnetic stainless steel.
   b. All hardware elements that bridge sash or frame thermal barrier: Reinforced nylon, deirin or suitable non-metallic, low conductivity material.
   c. Custodial key operation: Secure sash in closed position and automatically lock in washing position.
   d. Safety keys removable only in closed position.
2. Glass: See Section 08 81 00 for types of glass to be installed under this Section.

E. Fasteners:

1. Finish exposed fasteners to match finish of system.

2. Provide Phillips flat head screws where exposed.

F. Finish: AAMA 2605 Fluoropolymer paint; color to be clear anodized.

2.5 SOURCE QUALITY CONTROL

A. General Test Requirements:

1. Utilize independent testing laboratories specifically qualified to conduct all performance tests required.
2. Performance tests may be conducted in manufacturer's laboratories provided they are witnessed and certified by qualified independent testing laboratory personnel.
3. Perform all tests on "Test Unit":
   a. Full-sized window unit for project or a minimum 5 x 8 feet unit mounted in test chamber in exact accordance with job conditions including anchorage system, sealing, etc.
   b. Test unit to be completely assembled and glazed.
      1) Thermal tests may be conducted on 4 x 6 feet unit.
4. Test air infiltration first, water resistance second.
   a. Other tests may be in any order.
5. Test data on vertical pivot windows will be accepted for fixed windows for condensation resistance, thermal, temperature exposure and acoustical tests provided the fixed windows are the same as the vertical windows tested in the following respects:
   a. Same frame section (or same family of extrusions).
   b. Same basic metal mass inside and outside.
   c. Identical thermal break.
   d. Same type of glazing.

B. Test Requirements:

1. Air infiltration test:
   a. With sash and ventilators closed and locked, test in accordance with ASTM E283.
   b. Air infiltration, in CFM/FT of crack length, at pressure differential of 6.24 psf as follows:
      1) Fixed windows: 0.06 maximum, all others 0.10 maximum.
2. Water resistance test:
   a. Mount glazed unit in its vertical position, continuously supported around outside perimeter with sash and ventilators closed and locked.
   b. Test in accordance with ASTM E331.
   c. No uncontrolled leakage allowed, with pressure differential of 6.24 psf.
3. Uniform load deflection test:
   a. Test in accordance with ASTM E330.
   b. Subject unit to load of 25 psf applied to outside of window and 25 psf applied to inside of window.
   c. Maximum allowable deflection of any unsupported span: L/175.
   d. No glass breakage, permanent damage to fasteners, hardware parts, support arms or activating mechanisms, or any other damage which would cause window to be inoperable will be allowed.
4. Uniform load structural test:
   a. Test in accord with ASTM E330.
   b. Subject unit to loads indicated below.
   c. Stabilize pressure and maintain it for minimum period of 10 seconds.
   d. No glass breakage, permanent damage to fasteners, hardware parts, support arms or activating mechanisms or any other damage which would cause window to be inoperable will be allowed.

e. Maximum permanent deformation of any main frame, sash or ventilator member: 0.4% of its span.

f. After performing Uniform Load Structural Test, increase loads 1-1/2 times and perform safety test.

g. Design unit to withstand following design pressures acting normal to plane of wall, at applicable heights and locations excluding storm windows.

1) At height of 30 feet or less: 20 PSF acting inward 20 PSF acting outward.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Set units plumb, level, and true to line.

C. Anchor securely in place.

D. Separate metal surfaces from sources of corrosion or electrolytic action.

E. Set sill and base members in a bed of sealant.

F. Provide joint fillers or gaskets for weathertight construction.

G. Seal all joints within and at perimeter of system.

H. Provide sealant color to match finish of system at exposed locations.

I. Provide sealants compatible with aluminum system and recommended for use with this type of installation.

J. See Section 07 92 00 for sealants.

3.2 FIELD QUALITY CONTROL

A. Installation supervised or inspected by manufacturer's authorized representative.

END OF SECTION

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SECTION 08 51 13.13

ALUMINUM WINDOWS - HORIZONTAL SLIDE

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Aluminum Windows - Horizontal Slide, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Shop Drawings:

1. Elevations, sections, and details for review of support system to building frame.

C. Samples:

1. Range samples of aluminum finishes.

D. Project Information:

1. Certified independent laboratory test reports verifying requirements.

E. Contract Closeout Information:

1. Warranty.
2. Warrantable report by manufacturer's field service representative stating Aluminum Windows - Horizontal Slide systems have been installed in accordance with manufacturer's published specifications, drawings, details, and project design requirements.

1.3 QUALITY ASSURANCE

A. Provide Aluminum Windows - Horizontal Slide engineered by specialty structural engineer to support superimposed loads indicated.

1. Include headers and reinforcing members around openings.
2. Required details defining method of fastening throughout system and attachments to supporting primary structure included in engineering requirement.
3. Meet or exceed performance criteria, in addition to AAMA/WDMA/CSA 101/I.S.2/A440 for Architectural AW Performance Class windows, Performance Grade 100 (AW100) unless otherwise noted.

B. Installer Qualifications:

1. Firm with not less than ten (10) years successful experience in erection and installation of Aluminum Windows - Horizontal Slide similar in design and scale of systems proposed for this project.
2. Certified by Aluminum Windows - Horizontal Slide manufacturer in erection and installation of manufacturer's products.
3. Submit a minimum of five (5) references of projects similar in size and scope.
4. Submit results of monthly onsite inspections conducted by manufacturer's field service representative, to assure proper installation, to Architect.
5. Upon completion of project, submit report from manufacturer's field service representative.
    a. See Submittals, Contract Closeout Information, below.

C. Welding and Welders:

1. Utilize skilled and qualified welders, licensed where required in accordance with local building regulations.
2. Perform welding in conformance with AWS structural welding code.

1.4 SPECIAL WARRANTY

A. Written ten-year warranty, agreeing to repair or replace defective materials or workmanship, including noncompliance with specification requirements and industry standards, which result in failure of the curtain wall system, finish, glass, or parts.

1. Failure includes but not limited to:
   a. Defects in materials, workmanship, water infiltration of assembly, air infiltration of assembly, glazing, sealant, or defects which influence system capacity to perform as a weather tight envelope.
2. Glass:
   a. Free from obstruction of vision as a result of dust or film formation on internal glass surfaces caused by failure of hermetic seal.
   b. Warranty period: Ten (10) years.
3. Finish:
   a. Cracking, crazing, flaking, blistering, or combination of Anodized finishes:
      1) Warranty period: Ten (10) years.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Aluminum Windows - Horizontal Slide (type F):

1. Base:
   a. QuikServ SS-4035E, custom sizes per drawings.
2. Optional:
   a. Wausau Window and Wall Systems
   b. EFCO Corporation
   c. Peerless Products

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Design and fabricate curtain wall systems under responsibility of one manufacturer, with components sized for ease of shipping, distribution, and erection.

B. Design Wind Loads - Allowable Stress Design (ASD):

1. Use most restrictive of following:
   a. Wind pressures as required per local building code based on wind speed, exposure factor and importance factor noted in the Structural Drawings.
   b. Wind Pressures defined by Building Code as locally adopted and amended.
   c. Deflection values: Use the most restrictive of the following:
      1) Limit deflection to values specified for Uniform Design Load Test.
      2) Limit deflection to comply with Building Code as locally adopted and amended.
      3) Limit deflection to L/175 or 3/4 inches maximum.
2. Design structural components, including transoms, mullions, and anchors, complying with deflection and stress requirements.

C. Thermal Expansion and Structural Movement:

1. Expansion and contraction, caused by changes in surface temperature equal to delta T.

a. Delta T for this project: 200 deg F.

b. Thermal contraction/expansion in this range shall not cause buckling, stresses on glass, failure of joint seals, undue stress on structural elements, damaging loads on fasteners, reduction of performance, or other detrimental effects over this temperature range.

c. Operating windows and doors shall function normally over this temperature range.

2.3 PERFORMANCE REQUIREMENTS

A. Test in accordance with NAFS-2008 for Architectural AW Performance Class windows, Performance Grade 70 (AW70).

B. Air Infiltration:

1. 0.3 cfm per square foot at 6. 6.24 psf maximum pressure differential when tested in accordance with ASTM E283.

C. Water Infiltration:

1. No uncontrolled water leakage at 12.00 psf static pressure differential, with water application rate of 5 gph/SQFT when tested in accordance with ASTM E331 and ASTM E547.

D. Structural Test Performance Requirements:

1. Uniform Load Deflection Test:
   a. No deflection of any unsupported span L of test unit (framing rails, muntins, mullions) in excess of L/175 at both a positive and negative load of 70 psf design test pressure when tested in accord with ASTM E330.
2. Uniform Load Structural Test:
   a. Unit to be tested at 1.5 x design test pressure, both positive and negative, acting normal to plane of wall in accord with ASTM E330.
   b. No glass breakage; permanent damage to fasteners, hardware parts, or anchors; damage to make sliding glass doors inoperable; or permanent deformation of any main frame or ventilator member in excess of 0.2 percent of its clear span.

E. Condensation Resistance and Thermal Transmittance Performance:

1. Perform thermal tests in accordance with NFRC 102 and/or AAMA 1503 or provide finite element computer thermal modeling and calculations per NFRC 100, NFRC 705 or AAMA 507, using DOE/LBL THERM, WINDOW, and/or CMAST software.

2.4 MATERIALS

A. 4100i Double Slide Thermal Aluminum Windows by Wausau Window and Wall Systems

B. Extruded Aluminum: 6063-T5 or 6063-T6 alloy.

C. Glass:

1. See Section 08 81 00.

D. Sealant:

1. As specified in Section 07 92 00.
2. Match color of aluminum.

E. Thermal Break:

1. Continuous extruded polyamide nylon, reinforced and mechanically crimped.

F. Hardware:

1. Continuous extruded pull handle.
2. Automatic spring-loaded jamb locks.
3. Replaceable rollers and housings.

G. Fasteners:

1. Avoid use of exposed fasteners.
2. Where exposed fasteners cannot be avoided, use Phillips flat head screws.
3. Match window color.

H. Weatherstripping:

1. Woven pile weather-strip with side or center fins at center weathering seals, and interior and exterior sash-to-frame contact points.
2. Bulb-type neoprene at lower sash, with EPDM or PVC weather-strip at sash/frame water shed.

I. Screens:

1. Aluminum frame with finish to match window.
2. Fabric 18 x 16 aluminum mesh.
3. Provide for each operable window.
4. Mesh color: Charcoal .

J. Finish:

1. AA-M10C21A41, Class I, AAMA 611, Clear.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Field verify window opening dimensions prior to fabrication.

B. Verify building substrates permit installation of windows according to manufacturer's instructions, approved shop drawings, calculations, and contract documents.

C. Do not install windows until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Comply with manufacturer's installation recommendations.

B. Set units plumb and true.

1. Anchor securely in place.
2. Separate aluminum and other corrodible metal surfaces from sources of corrosion or electrolytic action.

C. Set frame members in sealant bed, joint fillers, or gaskets to provide weathertight construction.

D. Adjust operating sash and hardware to provide tight fit for smooth operation and weathertight closure.

E. Clean aluminum surfaces promptly after installation.

F. Remove excess sealant, dirt, and other substances.

G. Lubricate hardware and other moving parts.

H. Provide protection to ensure that units are without damage at time of acceptance by Owner.

3.3 FIELD QUALITY CONTROL

A. Field Tests - General:

1. Architect shall select Aluminum Windows to be tested when representative portion of Aluminum Windows have been installed, glazed, perimeter caulked and cured.
2. Test for water penetration in accordance with AAMA 501.2-03, Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems.

3. Where test results do not meet requirements: Correct deficiencies and implement improved installation procedures for completing balance of Storefront.

3.4 ADJUSTING AND CLEANING

A. Adjust windows for proper operation; recheck installation, weatherseal, sealants and other items of complete installation.

B. Repair or replace damaged components.

C. Clean glass and metal surfaces and remove labels before final acceptance.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes commercial door hardware for the following:

1. Swinging doors.
2. Other doors to the extent indicated.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
3. Content: Include the following information:
    a. Type, style, function, size, label, hand, and finish of each door hardware item.
    b. Manufacturer of each item.
    c. Fastenings and other pertinent information.
    d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    e. Explanation of abbreviations, symbols, and codes contained in schedule.
    f. Mounting locations for door hardware.
    g. Door and frame sizes and materials.
    h. Warranty information for each product.
4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:
    a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
    b. Complete (risers, point-to-point) access control system block wiring diagrams.
    c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

F. Storm Shelter Openings: Provide complete door systems for hurricane or tornado resistant storm shelters and other areas of refuge complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.

G. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware

(including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.

2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.

D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.

1. Quantity: Provide the following hinge quantity:
2. Two Hinges: For doors with heights up to 60 inchesThree Hinges: For doors with heights 61 to 90 inchesFour Hinges: For doors with heights 91 to 120 inchesFor doors with heights more than 120 inchesprovide 4 hinges, plus 1 hinge for every 30 inchesof door height greater than 120 inchesHinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
    a. Widths up to 3’0”: 4-1/2” standard or heavy weight as specified.
    b. Sizes from 3’1” to 4’0”: 5” standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
    a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
    b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
        1) Interior door that is 3'8" to 4'0" wide, require heavy weight hinges.
4. Hinge Options: Comply with the following:
    a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
    a. McKinney (MK) - TA/T4A Series, 5-knuckle.

B. Hinges at Storm Shelter Assemblies: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a Severe Storm Shelter Opening meeting ICC 500 and FEMA 361.

1. Quantity: Provide the following hinge quantity:
    a. Three Hinges: For shutters with heights 36 to 60 inches, and doors at height of 80 inches.

b. Four Hinges: For shutters with heights > 60 inches to 80 inches, and doors with heights greater than 84 inches.

2. Quantity: Provide the following hinge quantity:
   a. Three Hinges: For shutters with heights 36 to 60 inches, and doors at height of 80 inches.
   b. Four Hinges: For shutters with heights > 60 inches to 80 inches, and doors with heights greater than 84 inches.
   c. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   d. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
   e. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:
   a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
   b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
4. Hinge Weight and Base Material: At a minimum, provide heavy weight hinges with stainless steel screws used in accordance with and specified as part of a certified Storm Shelter Opening meeting ICC 500.
5. Manufacturers:
   a. McKinney (MK) - SP3386/SP3786.
   b. No Substitution.

2.3 POWER TRANSFER DEVICES

A. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:
   a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
   b. McKinney (MK) - Connector Hand Tool: QC-R003.
2. Manufacturers:
   a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
5. Manufacturers:
   a. Rockwood (RO).

B. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inchthick, size as indicated in hardware sets,with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Pulls, where applicable, shall be provided with a 10” clearance from the finished floor on the push side to accommodate wheelchair accessibility.
5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
6. Manufacturers:
    a. Rockwood (RO).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.
2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

C. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

D. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Two (2)
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

E. Construction Keying: Provide construction master keyed cylinders.

F. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 KEY CONTROL

A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent

markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.

1. Manufacturers:
   a. Lund Equipment (LU).
   b. MMF Industries (MM).
   c. Telkee (TK).

2.7 CYLINDRICAL LOCKS AND LATCHING DEVICES

A. Cylindrical Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.2, Series 4000, Operational Grade 1 Certified Products Directory (CPD) listed cylindrical locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Manufacturers:
   a. Corbin Russwin Hardware (RU) - CLX3300 Series.
   b. Sargent Manufacturing (SA) - 10X Line.

2.8 MULTI-POINT LOCKS AND LATCHING DEVICES

A. Multi-Point Locksets, Storm Shelter: Provide ANSI/BHMA A156.37, Series 1000, Operational Grade 1 and Security Grade 1 Certified Products Directory (CPD) listed multi-point locksets. Listed manufacturers shall meet all functions and features as specified herein.

1. Provide locksets with functions and features as follows:
   a. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
   b. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
   c. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
   d. Approved for usage as part of a complete ICC 500 (2014/2020) and FEMA P-361 (2015/2021) door, frame, and hardware assemblies for storm shelter components.
   e. Lever torque to retract all bolts less than 28 in.lb.
   f. Cycle tested to 1,000,000 cycles.
   g. Seven-year limited warranty for mechanical functions.
2. Manufacturers:
   a. Corbin Russwin Hardware (RU) - FE6600 Series.
   b. Sargent Manufacturing (SA) - FM7300 Series.

2.9 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.

3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.10 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.

1. Heavy duty surface mounted door closers shall have a 30-year warranty.
2. Manufacturers:
    a. Corbin Russwin Hardware (RU) - DC6000 Series.
    b. Norton Rixson (NO) - 7500 Series.
    c. Sargent Manufacturing (SA) - 351 Series.

C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:
    a. Corbin Russwin Hardware (RU) - Unitrol Series.
    b. Norton Rixson (NO) - Unitrol Series.

D. Door Closers, Surface Mounted (Cam Action): ANSI/BHMA 156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, high efficiency door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be of the cam and roller design, one piece cast aluminum silicon alloy body with adjustable backcheck and independently controlled valves for closing sweep and latch speed.

1. Manufacturers:
    a. Corbin Russwin (RU) - DC5000 Series.
    b. Norton Rixson (NO) - 2800ST Series.
    c. Sargent Manufacturing (SA) - 422 Series.

2.11 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1” LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16” above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer’s catalog and template book for specific requirements for size and applications.
4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
    a. Stainless Steel: 300 grade, 050-inchthick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
    a. Rockwood (RO).

2.12 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:
    a. Rockwood (RO).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:
    a. Norton Rixson (RF).
    b. Rockwood (RO).
    c. Sargent Manufacturing (SA).

2.13 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NFPA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).

2.14 ELECTRONIC ACCESSORIES

A. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

a. Securitron (SU) - DPS Series.

B. Intelligent Switching Power Supplies: Provide power supplies with single, dual or multi-voltage configurations at 12 and/or 24VDC. Power Supply shall have battery backup function with an integrated battery charging circuit. The power supply shall have a standard, integrated Fire Alarm Interface (FAI). The power supply shall provide capability for secondary voltage, power distribution, direct lock control and network monitoring through add on modules. The power supply shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs. Network modules shall provide remote monitoring functions such as status reporting, fault reporting and information logging.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.
2. Manufacturers:

a. Securitron (SU) - AQL Series.

2.15 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.16 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Door Closers:

1. Install closers on room side of corridor doors, and stair side of stairways.
2. Lobby doors: Mount on vestibule side.
3. Exterior doors: Parallel rigid arm installation.
4. Where through-bolts are required, install closers using only manufacturer-furnished through-bolts.
5. Install closers using only manufacturer-furnished template machine screws for metal doors and manufacturer -furnished wood screws for wood doors.
6. Coordinate with door supplier to provide proper blocking for surface mounting.
7. Use of self-drilling or self-tapping fasteners is not allowed.
8. Where full glazed door units are specified, use closer arm and mounting configuration as required to avoid use of drop brackets whenever possible.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

F. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.
2. The supplier is responsible for handing and sizing all products.
3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer’s Abbreviations:

1. MK - McKinney
2. RO - Rockwood
3. SA - SARGENT
4. RF - Rixson
5. NO - Norton

6. PE - Pemko
7. CR - Curries (Hardware Only)
8. SU - Securitron
9. OT - Other

Hardware Sets

Set: 1.0

Doors: 101A, 108A
Exterior - Card Reader (DPS): EL Lock (RTE) x Door Closer w/ Spring Stop

2	Hinge (qty per spec)	T4A3386 (size per spec, NRP as applicable)	US32D	MK	
1	Electric Hinge	T4A3386 QC (size per spec)	US32D	MK	⚡
1	Fail Secure Lock	RX 10XG71 LL	US26D	SA	⚡
1	Surface Closer	UNI7500	689	NO	
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO	
1	Rain Guard	346_		PE	
1	Latch Protector	320-RKW	US32D	RO	
1	Sweep	345_PK		PE	
1	Threshold	252 / 253 x__FG		PE	
1	Kerf Weather Seal	by frame manufacturer		CR	
1	ElectroLynx Harness	QC-C00_		MK	⚡
1	ElectroLynx Harness	QC-C3000_		MK	⚡
1	Position Switch	DPS		SU	⚡
1	Power Supply	AQL x Relay(s) (consolidate as applicable)		SU	⚡
1	Access Control Reader	By Division 28		OT	
1	Set Wiring Diagrams	By Division 28		00	

Door normally closed and locked.
Entrance by presenting a valid card to card-reader.
Egress allowed at all times.
Loss of power maintains security from lock side, entrance by mechanical key only.
Door monitored for door ajar and forced open.

Set: 2.0

Doors: 103A
StormPro 361 (T6) Door: Multi-Point Lock x Door Closer

4	Hinge, Hvy Wt	SP3786	US26D	MK
1	Multi-Point Lock	FM7325 LNL 188	US26D	SA
1	Surface Closer	7500 TBGN	689	NO
1	Wall Stop	RM860 / RM861	US26D	RO
1	Gasketing	S773		PE
1	Sweep	345 (as required)		PE

Application:
-Curries StormPro: 361 ("T6" - inswing or outswing)
-All door hardware to follow door manufacturer requirements

Door normally closed, unlocked, deadbolt retracted - free egress and ingress.
Outside trim locked when deadbolt is projected or by outside mechanical key.
Inside lever-turn or outside mechanical key will project or retract deadbolt.
Inside lever will retract both deadbolt and latch simultaneously allowing free egress at all times.

Set: 3.0

Doors: 107A

Pair: Storeroom Lock x Overhead Stop

6	Hinge (qty per spec)	TA2714 (size per spec, NRP as applicable)	US26D	MK
1	Dust Proof Strike	570	US26D	RO
1	Flush Bolt	555 / 557	US26D	RO
1	Storeroom/Closet Lock	10XG04 LL	US26D	SA
2	Surf Overhead Stop	10-X36	630	RF
1	Overlapping Astragal	"Z" Type by door manufacturer		00
2	Silencer	608		RO

Application:
-top flush bolt only.

Set: 4.0

Doors: 106A

Storeroom Lock x Overhead Stop

3	Hinge (qty per spec)	TA2714 (size per spec, NRP as applicable)	US26D	MK
1	Storeroom/Closet Lock	10XG04 LL	US26D	SA
1	Surf Overhead Stop	10-X36	630	RF
3	Silencer	608		RO

Set: 5.0

Doors: 104A, 105A

Privacy Lock (no indicator) x Door Closer

3	Hinge (qty per spec)	TA2714 (size per spec)	US26D	MK
1	Privacy Lock	10XU65 LL	US26D	SA
1	Surface Closer	PS2800ST / 2800ST	689	NO
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Wall Stop	RM860 / RM861	US26D	RO
1	Gasketing	S88		PE
1	Coat Hook	RM840	US32D	RO

Set: 6.0

Doors: 101B

Passage x Closer

3	Hinge (qty per spec)	TA2714 (size per spec)	US26D	MK
1	Passage Latch	10XU15 LL	US26D	SA
1	Surface Closer	R7500 / PR7500	689	NO
1	Kick Plate	K1050 10" high CSK BEV	US32D	RO
1	Wall Stop	RM860 / RM861	US26D	RO
1	Gasketing	S88		PE

END OF SECTION

SECTION 08 81 00
GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass and glazing.
2. Fire resistance rated glass.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 07 92 00 - Joint Sealants.
2. Section 08 11 13 - Hollow Metal Doors and Frames.
3. Section 08 14 16 - Flush Wood Doors.
4. Section 08 51 13 – Aluminum Windows
5. Section 08 51 13.13 – Aluminum Windows – Horizontal Slide

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI):
   a. Z97.1, Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
2. ASTM International (ASTM):
   a. C864, Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
   b. C1036, Standard Specification for Flat Glass.
   c. C1048, Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass.
   d. C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
   e. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
   f. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
3. Code of Federal Regulations (CFR):
   a. Title 16 - Commercial Practices, Chapter ii - Consumer Product Safety Commission (CPSC), Subchapter B - Consumer Product Safety Act Regulations:
      1) 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
4. Glass Association of North America (GANA):
   a. Glazing Manual.
5. Insulating Glass Certification Council (IGCC).
6. Insulating Glass Manufacturers Alliance (IGMA):
   a. TM-3000, North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use.
7. National Fire Protection Association (NFPA).
   a. 80, Standard for Fire Doors and Other Opening Protectives.
   b. 251, Standard Methods of Tests of Fire Resistance of Building Construction and Materials.
   c. 252, Standard Methods of Fire Tests of Door Assemblies.
   d. 257, Standard on Fire Test for Window and Glass Block Assemblies.
8. Underwriters Laboratories, Inc. (UL):

a. 9, Standard for Fire Tests of Window Assemblies.
b. 10B, Standard for Fire Tests of Door Assemblies.
c. 263, Standard for Fire Tests of Building Construction and Materials.

1.3 DEFINITIONS

A. Installer or Applicator:
1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Safety Glazing: Glazing meeting the requirements of the building code and CPSC 16 CFR 1201.

C. Other terms as identified in CSPC 16 CFR 1201.

1.4 SUBMITTALS

A. Shop Drawings:
1. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's installation instructions.
c. Certification that glass has been tested and approved for use in fire resistance rated doors or walls.
1) Copies of all test criteria.
2. Certification that insulating glass units meet requirements of IGCC and are certified by IGCC to ASTM E2190.

B. Samples:
1. Two, 12 x 12 inches sample of each type, color, and thickness specified.
a. Samples are not required for clear monolithic glass.

C. Informational Submittals:
1. Warranty.

1.5 WARRANTY

A. Provide manufacturer's written 10 year warranty to cover deterioration of glass, glass units, coatings and ceramic frit.
1. Insulating glass units shall be warranted against failure of hermetic seal resulting in fogging or film formation on the interior glass surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Glass:
a. Guardian Glass by Guardian Industries.
b. Insulite Glass Co., Inc.
c. NSG/Pilkington.
d. Oldcastle Building Envelope.
e. Vitro Architectural Glass.
f. Viracon.

2. Gaskets, glazing compounds, setting blocks, spacers, sealant, sealant tape, etc., as recommended by glass manufacturer, glass unit fabricator.

2.2 MATERIALS

A. General:

1. ASTM C1036.
   a. Clear glass: Type I, Class 1, Quality Q3.
   b. Tinted glass: Type I, Class 2, Quality Q3.
2. Thickness: 1/4 inches, unless noted otherwise.

B. Heat Strengthened and Fully Tempered Glass: ASTM C1048.

1. General use: Kind HS.
2. Safety glazing: Kind FT.
   a. Meet requirements of ANSI Z97.1 and CSPC 16 CFR 1201.
3. Condition:
   a. Clear or tinted vision glass: Condition A.
   b. Coated vision glass: Condition C.
      1) ASTM C1376, Kind CV or CO.

2.3 MANUFACTURED UNITS

A. Insulating Glass Units:

1. ASTM E2190, Class A.
2. Two lites of glass separated by a hermetically sealed air space.
   a. Spacer: Stainless steel "warm edge" spacer.
      1) Thickness: 1/2 inches.
      2) Color: Black.
   b. Perimeter Sealant: Silicone.
      1) Color: Black.

B. Laminated Safety Glass:

1. ASTM C1172, Type II.
   a. Meet requirements of ANSI Z97.1 and CSPC 16 CFR 1201.
2. Interlayer: Clear plastic manufactured specifically for use in laminated glass.

2.4 ACCESSORIES

A. Glazing Compounds:

1. Non-sag, non-stain type.
2. Pigmented to match frame units not requiring painting.
3. Compatible with adjacent surfaces.
4. One- or two-part polyurethane or silicone sealant for use in setting glass.
   a. Provide glazing compounds which will not be affected by chemicals stored in rooms where glazing compounds are used.

B. Sealant Tape: Butyl rubber sealant tape or ribbon having a continuous neoprene shim.

C. Gaskets:

1. Flexible polyvinyl chloride or neoprene.
   a. ASTM C864.
   b. Provide gaskets which will not be affected by chemicals stored in rooms where gaskets are used.

2. Extruded of profile and hardness required to receive glass and provide a watertight installation.
3. Provide gaskets in accordance with NFPA in fire resistance rated glazing.

D. Setting Blocks and Spacers:

1. Neoprene or EPDM, compatible with sealants used.
   a. ASTM C864.

E. Compressible Filler Stock: Closed cell polyethylene or polyethylene jacketed polyurethane foam.

F. Shims, Clips, Screws and Other Miscellaneous Items: As required by condition.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with recommendations of manufacturer, GANA Glazing Manual and IGMA TM-3000.

B. Install setting blocks in adhesive or sealant.

C. Install spacers inside and out, of proper size and spacing, for all glass sizes larger than 50 united inches, except where gaskets are used for glazing.

D. Provide 1/8 inches minimum bite of spacers on glass.

E. Spacer thickness to equal sealant width.

F. Prevent sealant exudation from glazing channels of insulating glass which is more than 1/2 inches thick; colored, heat absorbing, coated or laminated glass sizes larger than 75 united inches; and other glass more than 9/32 inches thick or larger than 125 united inches.

1. Leave void at heel (or install filler) at jambs and head.
2. Do not leave void (or install filler) at sill.

G. Miter cut and bond gasket ends together at corners.

H. Immediately after installation, attach crossed streamers to framing held away from glass.

I. Use polysulfide-based glazing sealants in window assembly and as perimeter sealant around frames in areas which may be exposed to chlorine gas or chlorine liquid splash or spillage.

1. See Specification Section 07 92 00 for sealants.

J. Install fire resistance rated glass in accordance with manufacturer's recommendations and in accordance with applicable fire testing criteria.

3.2 FIELD QUALITY CONTROL

A. Do not install glass with edge damage.

B. Do not apply anything to surfaces of glass.

C. Remove and replace damaged glass.

3.3 CLEANING

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.

B. Wash and polish glass on both faces not more than seven days prior to acceptance of work in each area.

1. Comply with glass manufacturer's recommendations.

3.4 SCHEDULES

A. General:

1. Provide safety glazing for all applications where required by the building code and CPSC 16 CFR 1201.
2. Provide heat strengthened glazing for all general use applications where safety glazing is not required.

B. Glass Type 1: Clear Monolithic Glass.

C. Glass Type 2: Tinted Monolithic Glass.

1. Color: Clear.

D. Glass Type 3: Insulating Low-E Units.

1. Exterior lite: 1/4 inches with Solarban 90 on #2 surface.
   a. Color: Clear.
2. 1/2 inches dehydrated air space.
3. Interior lite: 1/4 inches clear.
4. Performance Requirements:
   a. Transmittance:
      1) Visible light: 51%.
      2) UV: 7%.
   b. Reflectance:
      1) Exterior: 37%.
      2) Interior: 19%.
   c. U-Value
      1) Winter: 0.29.
   d. Shading Coefficient: 0.27.
   e. Solar Heat Gain Coefficient (SHGC): 0.23.
5. Manufacturer Basis-of-Design: Vitro.

E. Glass Type 4: Insulating Low-E Laminated Glass Units.

1. Exterior lite: 1/4 inches with Viracon VUE-50 on #2 surface.
   a. Color: clear
2. 1/2 inches dehydrated air space.
3. Interior lite: Laminated Glass.
   a. Exterior ply: 1/4 inches clear.
   b. Interlayer: See MANUFACTURED UNITS Article in PART 2.
   c. Interior ply: 1/4 inches clear.
4. Performance Requirements:
   a. Transmittance:
      1) Visible light: 51%.
      2) Solar energy: 21%.
      3) UV: <1%.
   b. Reflectance:
      1) Exterior: 12%.
      2) Interior: 12%.
      3) Solar: 36%.
   c. U-Value
      1) Winter: 0.24.
      2) Summer: 0.21.
   d. Shading Coefficient: 0.29.

e. Relative Heat Gain: 61.

f. Solar Heat Gain Coefficient (SHGC): 0.25.

5. Viracon .

F.

END OF SECTION

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Louvers and vents.

B. Related Sections include but are not necessarily limited to:

1. Section 07 62 00 - Flashing and Sheet Metal.
2. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA):
   a. DAF 45, Designation System for Aluminum Finishes.
2. Air Movement and Control Association (AMCA).
3. ASTM International (ASTM):
   a. B221, Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.3 SUBMITTALS

A. Shop Drawings:

1. Drawing showing location of each louver or vent, indicating size and arrangement of blank-off plates if required.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Color chart showing manufacturer's full line of colors including exotic and special colors for color selection by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Louvers:
   a. Airolite Company LLC.
   b. Construction Specialties, Inc.
   c. Ruskin Company.
   d. Industrial Louvers, Inc.
   e. American Warming and Ventilating.

2.2 MANUFACTURED UNITS

A. Louvers:

1. 4 inches deep.
2. Drainable with blades at 37-1/2 degrees.
3. Continuous blade appearance.

4. ASTM B221 extruded aluminum, alloy 6063T5, minimum 0.081 inches thick.
5. Minimum free area: 8.58 square feet for 4 x 4 feet louver.
6. Maximum pressure drop: 0.10 inches of water at 700 fpm.
7. Water penetration: 0.01 oz/SQFT at 873 fpm.
8. AMCA certified.
9. Ruskin "ELF 375DX".
10. Insect screen:
    a. 18-16 mesh aluminum.
    b. Install in standard aluminum frame.

B. Anchors, Fasteners, Reinforcing: Aluminum or stainless steel.

C. Finish:

1. Meet requirements of AAMA 2605.
    a. PVDF coating with minimum 70% resin content.
    b. Color: To be selected by Engineer.

D. Size: Refer to Mechanical Drawings for louver size, and refer to Architectural Drawings for louver shapes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchoring and bracing accessories as required.

C. Seal around perimeter on exterior and interior.

1. See Section 07 92 00.

D. Install 0.040 inches aluminum flashing at sill to match louver .

1. See Section 07 62 00.

END OF SECTION

DIVISION 09

FINISHES

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Non-Structural Metal Framing in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. The American Iron and Steel Institute (AISI):

1. AISI S220 North American Standard for Cold-Formed Steel Framing – Nonstructural Members.

B. ASTM International (ASTM):

1. ASTM C635 Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
2. ASTM C645 Standard Specification for Nonstructural Steel Framing Members.
3. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
4. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
5. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.

C. Gypsum Association (GA):

1. GA-216 Application and Finishing of Gypsum Panel Products.
2. GA-234 Control Joints for Fire-Resistance Rated Systems.

1.3 SUBMITTALS

A. Shop Drawings:

1. Sizes and spacing of typical framing members and opening framing.
2. Show locations and sizes of atypical framing members, wall framing sections, and opening elevations.
3. Methods of fastening framing members to each other and to supporting systems.
4. Details of vertical deflection connections to structures.
5. Locations and spacing of lateral bracing and structural bracing systems.
6. Accessory products required for complete installation.

B. Product Data:

1. Manufacturer’s specifications for each type of material and accessory.
    a. Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.
2. Where EQ coatings are used, submit copies of nationally recognized testing laboratory results showing conformance with ASTM A653 and AISI S220.
    a. Include data required to show specification compliance.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Member of Certified Steel Stud Association (CSSA), Steel Framing Industry Association (SFIA), or Steel Stud Manufacturers Association (SSMA).

A. Code-Compliance Certification of Studs and Tracks:

1. Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Non-Structural Metal Framing:

1. Base:
   a. ClarkDietrich Building Systems
2. Optional:
   a. CEMCO Steel Framing and Metal Lath
   b. Custom Stud Inc.
   c. Marino/WARE
   d. MBA Metal Framing
   e. MRI Steel Framing LLC
   f. Telling Industries
   g. The Steel Network

B. Flexible Track:

1. Base:
   a. ClarkDietrich Building Systems
2. Optional:
   a. The Steel Network
   b. Flex-Ability Concepts

C. Isolation Strip Material:

1. Base:
   a. Reflectix, Inc.
2. Optional:
   a. Saint-Gobain

D. Knee Wall Brace:

1. Base:
   a. Pittcon Industries
2. Optional:
   a. ClarkDietrich Building Systems

E. Interlocking Grid Support Systems for Gypsum Board Ceilings:

1. Base:
   a. USG Corporation
2. Optional:
   a. Armstrong
   b. Chicago Metallic

F. Other manufacturers desiring approval comply with Section 01 61 00.

G. Products proposed for use in fire-rated assemblies:

1. Approved by nationally recognized testing laboratory.

2.2 DESIGN CRITERIA

A. Select steel studs in accordance with manufacturer's standard load tables and following design pressures and maximum deflections:

Performance Criteria		
Use Condition [2]	Design Pressure	Maximum Deflection
Wall enclosing stairs, elevator hoistways, and other vertical shafts	10 pounds/SF	L/240
Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions	15 pounds/SF	L/240
Walls scheduled with Tile Backer Board, Moisture-Resistant, Impact-Resistant, or Abuse-Resistant Gypsum Wallboard	5 pounds/SF	L/360
Walls scheduled to receive Tile, lath and plaster, or veneer plaster. [1]		L/360
Typical Interior Walls/Partitions (those not listed above)	5 pounds/SF	L/240
Interior Ceilings, Soffits and Bulkheads	5 pounds/SF	L/360

Footnotes

1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered Stone, Veneer Plaster, and similar brittle finishes which are prone to movement induced cracking.
2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.

2.3 MATERIALS

A. Metal Studs and Floor Tracks:

1. C-shaped, roll formed studs and tracks conforming to ASTM C645.
2. Steel design standard: 33KSI.
3. Galvanized: G40 or G40EQ conforming to ASTM A653 and AISI S220.
4. Stud and track depths: As indicated by wall type.
5. Minimum flange width: 1-1/4-inch.
6. Minimum thickness: 30 mil (20 GA), except as follows:
   a. Increase member thickness to comply with performance criteria.
   b. Decrease member thickness to minimum 18 mil (25 GA) studs at following condition:
      1) Where walls do not extend to overhead structural deck and supporting diagonal bracing or horizontal stiffeners are used.
7. In lieu of increased member thickness, design may employ diagonal braces above ceiling to reduce overall span.
   a. Coordinate locations with building services items.
   b. Do not employ studs with member thickness less than allowed by fire resistance rated assemblies.
8. High strength 50 ksi or 70 ksi studs shall comply with design criteria of equivalent thickness standard 33 ksi studs listed.
9. At walls designated STC 40 and above, use only studs with physical characteristics of studs used in documented STC testing.
10. Base product: ProSTUD Drywall Framing by ClarkDietrich.
11.

B. Flexible Track:

1. Adjustable segmented track fabricated from same material, gauge, and width as specified for straight track.
2. Use at curved walls and soffits.
3. Base product: 360Trak by ClarkDietrich.

C. Head of Wall Accessories:

1. Configure to accommodate deflection of superstructure without inducing axial loading on partition wall.
2. Maintain structural integrity, fire and smoke-resistance, and sound control as required by each wall.
3. Slotted top deflection track:
   a. Deep leg, vertically slotted track.
   b. Cold-formed sheet steel; galvanized; G60.
   c. Thickness: 30 mil (20 GA) minimum.
   d. Width: As required for stud sizes indicated.
   e. Depth: Minimum 2-1/2-inch down-standing legs with 1/4-inch wide by 1-1/2-inch high slots spaced 1 inch on center.
   f. Base product: MaxTrak by ClarkDietrich.
4. Z-bars, cold formed channels, and clips:
   a. Accommodate thickness of spray-applied fire-resistive materials.
5. UL-listed fire-resistant components tested for compliance with requirements indicated.
6. Firestopping Materials:
   a. Sealants, sprays, intumescent strips and forming materials.
   b. Coordinate with sealants specified in Section 07 92 00.
   c. Intumescent applications:
      1) Factory or field applied.
   d. Base product: Blazeframe by ClarkDietrich.

D. Z-Bar Standoff Clips:

1. 30 mil (20 GA) galvanized steel.
2. Provide Z-bars for attachment of top track to superstructure elements which are to be protected with sprayed fireproofing.
   a. Size: 2 by 2 by 2 inch.
3. Length:
   a. As required to accommodate beam and deck fireproofing.
      1) At structural steel member: Length equal to flange width of structural steel member.
      2) At steel deck: Minimum length equal to partition width, or as required to span steel deck flutes.
   b. Extend length of Z-bar to accommodate partition offset that will not clear fireproofed steel beam.

E. Furring Channels:

1. Hat shaped sections.
2. Galvanized: G40 or certified equivalent.
3. Sizes: 7/8 inch and 1-1/2 inch, as indicated.
4. Minimum Thickness: 30 mil (20 GA); Use heavier gauge as dictated by conditions.
5. Base product: Furring Channel/ Hat Channel by ClarkDietrich.

F. Metal Backing:

1. General:
    a. See Drawings for applications of backing types listed and further details.
    b. Use heavier gauge as necessary for items to be supported.
    c. Comply with manufacturer's backing requirements if capacity exceeds types listed.
2. Flat Plate (Type A):
    a. Flat, sheet metal stock per ASTM A1008.
    b. G40 galvanized or certified equivalent.
    c. Thickness: 43 mil (18 GA) minimum.
3. Metal Backing (Type B):
    a. C-shaped modified track runners.
    b. G40 galvanized or certified equivalent.
    c. Backing height: 6 inches minimum.
    d. Flange width: 1-1/4-inch minimum.
    e. Thickness: 30 mil (20 GA) minimum.
    f. May be installed continuously across multiple stud spaces.
    g. Use where no other type of backing is designated.
4. Metal Backing (Type C):
    a. C-shaped modified track runners.
    b. G40 galvanized or certified equivalent.
    c. Backing height: 8 inches minimum.
    d. Flange width: 1-1/4-inch minimum.
    e. Thickness: 54 mil (16 GA) minimum.
    f. Install at single stud space with properly oriented studs.

G. Accessory Items:
1. Wire Ties:
    a. Minimum thickness: 43 mil (18 GA) soft annealed, galvanized.
2. Track Fasteners:
    a. Power driven type, to withstand minimum 190 pounds shear when driven.
3. Knee Wall Brace:
    a. Steel tube and baseplate bolted to concrete floor slab with tube projecting vertically; concealed within framed walls to provide structural stability for knee walls.
    b. Design components compatible with wall type.
    c. Material: Cold-rolled steel tube and base plate.
    d. Fully welded.
    e. Overall height: Wall height less 2 inches.
    f. Spacing as recommended by manufacturer.
    g. Base product: SKB Series by Pittcon Industries.

H. Support Systems for Gypsum Ceilings:
1. Interlocking Grid Systems:
    a. ASTM C635, direct-hung system composed of T-Shaped framing members designed to carry load of screw-applied gypsum ceiling board.
    b. Tabs on Cross-Tees to interlock into slots in Main Runners where intersections occur.
    c. Base Product: Drywall Suspension System by USG Corporation.
2. Track and Channel Systems:
    a. ASTM C645 roll-formed steel with G40 galvanized coating.
    b. Thickness: 30 mil (20 GA) minimum; Use heavier gauge as dictated by conditions.

c. Carrying channels:
    1) Size: 1-1/2-inch.
d. Furring channels:
    1) Sizes: 7/8-inch and 1-1/2-inch, as indicated.

3. Stud-Framed Ceiling/Soffit Systems:
    a. C-shaped studs or joists; roll-formed.
    b. Galvanized: G40.
    c. Frame member depth: 3-5/8-inch minimum, unless otherwise indicated.
        1) Use wider stud sections if ceiling span and support requires.
    d. Flange width: 1-1/4-inch minimum.
    e. Stud thickness: 33 mil minimum.
4. Tie Wire:
    a. ASTM A641, Class 1 zinc coating, soft temper.
    b. Diameter, single strand: 62 mil (14 GA) minimum.
    c. Diameter, double strand: 42 mil (18 GA) minimum.
5. Wire Hangers:
    a. ASTM A641, Class 1 zinc coating, soft temper.
    b. Diameter: 97 mils (12 GA) minimum.
6. Anchors in Concrete:
    a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512 as applicable.
    b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
    c. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 for Class SC 1 service condition.
7. Powder-Actuated Fasteners in Concrete:
    a. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190.
    b. Comply with seismic design requirements where applicable.
8. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting structure and conditions under which system will be installed.

B. Correct conditions detrimental to proper installation.

C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

A. Layout and install metal framing accurate to dimensions indicated in drawings.

B. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.

1. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, wall stops, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

F. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

G. Extend framing full height to structural supports.

1. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
2. Continue framing around ducts and similar items which penetrate partitions.

H. Position studs vertically engaging floor track and head of wall deflection track.

1. Align stud knockouts to facilitate running of wires and conduit.

I. Space studs maximum 16 inches on center.

1. Stud spacing at Shaftwall: 24 inches on center.

J. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.

K. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool per ASTM C754.

L. Anchor studs to deflection track with wafer head screws on both flanges of each stud.

1. Maintain deflection gap between top of stud and top of slotted track.
2. Install screws at centerline of slot and secure allowing vertical movement.

M. Anchor fire rated partitions as required by fire resistance design, and firestopping design.

N. Where partitions abut vertical structural elements, provide perimeter relief per Gypsum Association GA-600 Strain Relief System details.

O. Head-of-Wall:

1. Provide slotted top track for walls extended to structure.
2. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
3. Secure deflection track to structure in accordance with industry standards and regulatory requirements.
4. Secure at corners and at ends.
5. Cut vertical studs 5/8-inch short to create a deflection gap when installed into top track.
    a. Secure vertical studs to top track with framing screw at each stud, screwing through track slots for positive stud connection.
6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.

P. Furring Channels:

1. Attach furring channel systems directly to parent walls.
2. Install channels at maximum 16 inches OC.
3. Provide additional framing at openings, cutouts, corners, and control joints.
4. Space fasteners not more than 24 inches OC, staggered on opposite flanges of furring channels.

Q. Sound Isolation Clips:

1. Install per manufacturer's instructions.
2. Where electrical device, outlet, and service boxes are fastened to framing with Sound Isolation Clips:
    a. Leave a gap between the gypsum wallboard and the electrical device, outlet, or service box to avoid flanking of the Sound Isolation Clips.
    b. Seal the gap with Acoustical Sealant.

R. Stud Wall Isolation Strip:

1. Install per manufacturer's instructions.

3.3 FRAMING AT OPENINGS

A. Control Joints (CJ):

1. Install additional stud, maximum 1/2 inch from jamb studs.
2. Do not fasten extra stud to track or jamb stud.
3. Refer to specification Section 09 29 00 for control joint locations.

B. Prefabricated headers, jambs, and sill framing systems option:

1. Proprietary opening framing systems may be used as an alternative to conventionally fabricated framing.
2. Pre-approved Products:
    a. HDS Framing System by ClarkDietrich.
    b. Quick Frame Rough Opening System by Marino/ Ware.

C. Door Openings:

1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section for cripple studs at head and secure to jamb studs. Screw into web of jamb stud.
2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.
3. Jamb Studs:
    a. Minimum thickness of jamb studs: 30 mil (20 GA) at openings.
    b. Install two studs at each jamb, toe-to-toe unless otherwise indicated.
        1) Securely attach first stud to frame.
        2) Fill cavity between studs with acoustic batt insulation where required by acoustical rating of wall.
        3) Join second stud to first stud on each face with 30 mil (20 GA) screw attached steel straps at 42 inches on center maximum.
4. Headers:
    a. Openings less than 4 feet 6 inches wide:
        1) Cut-to-length section of floor runner above and below wall openings.
        2) Cut flanges and bend webs at ends.
        3) Overlap and screw attach jamb studs to frames.
    b. Openings over 4 feet 6 inches wide:
        1) Cut-to-length, horizontal box beam studs above and below wall openings.
        2) Design for actual span and loading.
    c. Incorporate miscellaneous steel members, specified in Section 05 50 00, and wood blocking, specified in Section 06 10 00, where indicated.
5. Control Joints at head of jambs:
    a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    b. Gypsum Wallboard control joints as specified in Section 09 29 00.

D. Other Framed Openings:

1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
2. Cripple Studs:
   a. Install cut-to-length intermediate vertical studs above and below openings.
   b. Spacing: As indicated for typical full-length studs.
   c. Match stud framing below sills of openings to framing installed above opening.
3. Incorporate miscellaneous steel members, specified in Section 05 50 00, and wood blocking, specified in Section 06 10 00, where indicated.

3.4 WALL BACKING AND BLOCKING

A. Provide in-wall backing reinforcement where following items are mounted to interior walls and interior face of exterior walls:

1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
2. Wall-mounted door stops.
3. Contractor or Owner furnished equipment indicated to be wall mounted.
4. Toilet accessories that do not include proprietary backing devices.
5. Toilet partitions and lockers.
6. Markerboards, tackboards, and chalkboards.
7. Other wall-mounted items where backing is indicated by details or specification.

B. Metal Wall Backing requirements are described as Accessory Items in Part 2 of this section.

C. Wood Wall Blocking may be used where allowed by Code and Manufacturer of item to be supported. Specified in Section 06 10 00.

D. Verify metal stud framing has been installed to support wall-mounted items specified in Section 05 50 00.

E. Coordinate mounting height, location, and coverage with item to be supported.

F. Determine material width according to item to be supported.

G. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.5 CEILING FRAMING

A. Install in compliance with manufacturer's recommendations.

B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.

C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.

1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

3.6 CEILING SUPPORT SYSTEMS

A. Install suspension system components in sizes and spacing indicated on Drawings, but not less than required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where abutting or penetrated by building structure.

C. Suspend hangers from building structure as follows:

1. Install hangers plumb and free from contact with insulation or other objects that are not part of supporting structural or suspension system.

a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.

2. Where width of ducts and other construction within ceiling plenum interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and secure fasteners appropriate for substrate.
4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and secure fasteners appropriate for structure and hanger.
5. Do not attach hangers to steel roof deck.
6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems:

1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
3. Install suspension systems that are level to within 1/8-inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.
4. Coordinate support requirements for in-ceiling devices with capacity of ceiling grid system.

END OF SECTION

SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gypsum board.
2.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 07 92 00 - Joint Sealants.
2. Section 09 22 16 - Non-Structural Metal Framing.
3. Section 09 91 10 - Architectural Painting.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   b. C475/C475M, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
   c. C840, Standard Specification for Application and Finishing of Gypsum Board.
   d. C1002, Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   e. C1047, Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
   f. C1396/C1396M, Standard Specification for Gypsum Board.
   g. D3273, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
2. Gypsum Association (GA):
   a. GA-214, Recommended Levels of Gypsum Board Finish.
3. Underwriters Laboratories, Inc. (UL):
   a. Building Materials Directory.
   b. Fire Resistance Directory.

1.3 DEFINITIONS

A. Wet Area:

1. Toilet rooms, showers, janitor closets, or similar areas.
2. Areas within 5 feet of service sinks, or mop sinks.

1.4 SUBMITTALS

A. Shop Drawings:

1. Drawings of unusual conditions.
   a. Control joint layout.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.

3. Manufacturer's adhesive, joint treatment compound and tape recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Gypsum board and accessories:
   a. American Gypsum.
   b. Georgia-Pacific Gypsum LLC.
   c. National Gypsum.
   d. USG Corporation.
2. Coated Fiber-faced Gypsum Board and Underlayment:
   a. Georgia-Pacific Gypsum LLC.
   b. USG Corporation.

2.2 MATERIALS

A. General:

1. Provide UL Listed materials in fire-resistant rated construction.
2. Furnish in lengths as long as practicable.

B. Gypsum Board (GB):

1. ASTM C1396/C1396M.
2. Thickness: 5/8 inches unless noted otherwise.
3. Edges: Tapered.
4. Fire-rated board: Type X.
1. Water and Mold Resistant Gypsum Board (WRGB):
   a. Water-resistant core and treated paper facers.
      1) Smooth face for finishing similar to standard gypsum board.
   b. Mold-resistant: ASTM D3273.
   c. USG "Sheetrock Mold Tough".

2.3 ACCESSORIES

A. Trim:

1. ASTM C1047.
2. Galvanized: ASTM A653/A653M G-60, unless noted otherwise.
3. Corner bead:
   a. Standard type with perforated flanges.
   b. ClarkDietrich "#103 Deluxe Corner Bead".
4. Casing and trim bead:
   a. ClarkDietrich "#200-A Metal U-Trim.
5. Control and expansion joints:
   a. ClarkDietrich "#093 Zinc Control Joint."

B. Fasteners:

1. Gypsum board:
   a. ASTM C1002.
   b. Self-drilling, corrosion-resistant bugle head screws.
      1) For fastening gypsum board to metal framing: Type S.

C. Adhesive: As recommended by board manufacturer.

D. Joint Tape:

1. ASTM C475/C475M.
2. Recommended by manufacturer for specified board type and location.

E. Joint Treatment Compound:

1. ASTM C475/C475M.
2. Recommended by manufacturer for specified board type and location.

F. Gypsum Board Suspension System:

1. Direct hung factory fabricated heavy duty rated, single web system.
2. Electro-galvanized.
3. Fire rated system, UL listed.
4. Chicago Metallic "Fire Front 650 Drywall Furring System."

G. Tie Wire and Suspension Wire:

1. Galvanized, soft annealed 12 GA minimum.
2. Use soft stainless steel wire of same gage in all wet areas and/or exterior areas.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Verify that metal stud framing has been installed plumb, true, and in accordance with the Contract Documents.
2. Prior to application of gypsum board, ensure that all blocking, backing and bracing has been installed as necessary for the support of appurtenant items.
3. Install gypsum board in accordance with ASTM C840.
4. Install board in fire-rated construction in accordance with UL requirements.
   a. Self-adhesive applied fire rated tape is not acceptable for use on board joints in fire rated walls.
   b. Tape all joints using conventional fire rated joint tape and joint treatment compound.
5. Erect all board vertically with edges over supporting members.
   a. See Specification Section 09 22 16 non-structural metal framing.
6. Secure to each support or framing member with screws.
   a. Provide fasteners of sufficient length to penetrate framing member or stud not less than 3/8 inches.
7. In curved wall or ceiling applications use 1/4 inches thick board specifically designed for use in radius construction.
   a. Apply in multiple layers as required to meet minimum drywall thickness specified.
8. In areas having gypsum board ceilings and walls, install ceiling first.
9. Bring boards into contact, but do not force into place.
10. Fit neatly and carefully.
11. Stagger edge joints on opposite side of a partition so they occur on different framing members.
12. Hold board in firm contact with support while fasteners are being driven.
13. Proceed with attachment from center of board toward ends and edges.
14. Scribe board prior to cutting.

15. Where gypsum board abuts concrete, masonry, metal deck, exterior doors and windows, or other dissimilar material; provide 3/8 inches joint between edge of gypsum board and abutting material.
    a. Provide continuous casing bead trim on edge of board.
    b. Seal joint with sealant and backer rod.
    c. See Specification Section 07 92 00 for sealant.
16. Use water-resistant gypsum board (WRGB) in wet locations not scheduled to receive tile finish or abuse resistant panels (ARP).

B. Installation:
1. Set fasteners between 3/8 and 1/2 inches from edges and 2 inches in from board corner.
    a. Space maximum of 12 inches on center at edges and in field of board.
    b. Where board butts at wall/ceiling juncture, hold fasteners back 6 inches from edges.
    c. Space fasteners closer if required by UL.
2. Install fasteners, in gypsum board, so that head rests in a slight dimple without cutting face paper or fracturing core or as recommended by board/panel manufacturer.

C. Control Joints:
1. Install prefabricated control joints to provide following maximum unjointed lengths or areas:
    a. Partitions: 30 feet, maximum straight run, and at both sides of jamb from head of each door, borrow lite, or window opening to top of partition.
        1) Control joints are not required at openings where the partition forms a cross-corridor condition.
        2) At borrow lites, windows or similar conditions, extend control joints at jamb from sill to floor.
    b. Ceilings:
        1) 50 feet maximum in one direction,
        2) At change of direction or irregular shapes.
        3) Ceiling area: 2500 square feet, maximum.
2. Where control or expansion joints occur in fire or sound rated assemblies, install suitable backing material to maintain required rating.
3. Where a partition or ceiling abuts a structural element or dissimilar wall or ceiling, install corner bead, casing bead or other trim as required.

D. Gypsum Board Finishing:
1. Securely attach continuous corner beads to all external corners in accordance with manufacturer's recommendations.
2. Provide the following minimum levels of gypsum board finish in accordance with GA-214.
    a. Areas exposed to view:
        1) Surfaces to receive vinyl wall covering: Level #4.
        2) Surfaces to receive painted finish: Level #5.
    b. Areas not exposed to view:
        1) Fire rated partitions: Level #2 unless a higher grade of finish is required by UL.
        2) Non-fire rated partitions: Level #2.
    c. Provide additional coats of joint compound as required to completely conceal joints, fasteners and accessories.
        1) Joint photographing will not be acceptable.
3. Sand each coat to remove excess joint compound.
    a. Avoid roughing paper facing on board.
4. Finish surface shall be smooth and free of tool marks and ridges.

5. Prime gypsum board surfaces in accordance with Specification Section 09 91 10.
    a. After primer has been applied, inspect surfaces and repair and refinish all areas which show defects.
6. Refer to ASTM C840 for additional finishing requirements.

E. Coated Fiber-faced Gypsum Board Finishing:

1. Follow the manufacturer's published installation instructions.
2. In showers or similar wet areas scheduled to receive a tile finish:
    a. Seal perimeter, joints and penetrations in accordance with manufacturer's instructions to provide a water-tight installation.
    b. Apply fiberglass mesh tape and finish with latex modified mortar per manufacturer's instructions.
    c. Cover fasteners with latex modified mortar.
3. In wet areas scheduled to receive a painted finish:
    a. Apply paper joint tape with setting-type joint compound.
    b. Finish per the Gypsum Board Finishing paragraph in this Section.

END OF SECTION

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SECTION 09 30 00
TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Tile, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. Tile Council of North America (TCNA):

1. Handbook for Ceramic, Glass and Stone Tile Installation, latest edition.

B. Ceramic Tile Institute of America (CTIOA).

A. ASTM International (ASTM):

1. ASTM C373 Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products
2. ASTM C485 Standard Test Method for Measuring Warpage of Ceramic Tile
3. ASTM C623 Standard Test Method for Young's Modulus, Shear Modulus, and Poisson's Ratio for Glass and Glass-Ceramics by Resonance.
4. ASTM C627 Standard Test Method for Evaluating Ceramic Floor Tile Installation Systems Using Robinson-Type Floor Tester
5. ASTM C630 Standard Test Method for Resistance of Ceramic Tile to Chemical Substances
6. ASTM C648 Standard Test Method for Breaking Strength of Ceramic Tile
7. ASTM C1026 Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling
8. ASTM C1027 Standard Test Method for Determining Visible Abrasion Resistance of Glazed Ceramic Tile
9. ASTM C1378 Standard Test Method for Determination of Resistance to Staining
10.
11. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
12. ASTM E413 Classification for Rating Sound Insulation Class
13. ASTM E492 Standard Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine
14. ASTM E989 Standard Classification for Determination of Single-Number Metrics for Impact Noise

B. American National Standards Institute (ANSI):

1. ANSI A108.5 Installation of Ceramic tile with Dry-Set Portland Cement or Latex-Portland Cement.
2. ANSI A108.10 Installation of Grout in Tilework.
3. ANSI A108.13 Installation of Membranes for Thin-Set Ceramic Tile.
4. ANSI A108.17 Installation of Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone.
5. ANSI A118.1 Standard Dry-Set Cement Mortars.
6. ANSI A118.3 Chemical Resistant, Water-Cleanable, Tile-Setting and-Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.

7. ANSI A118.4 Modified Dry-Set Cement Mortar.
8. ANSI A118.7 High Performance Cement Grouts.
9. ANSI A118.10 Load-Bearing, Bonded Waterproofing Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
10. ANSI A118.12 Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.
11. ANSI A118.15 Improved Modified Dry-Set Cement Mortars.
12. ANSI A136.1 Organic Adhesives for Installation of Ceramic Tile.
13. ANSI A137.1 Standard Specification for Ceramic Tile.
14. ANSI A137.3 Standard Specification for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs.

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Shop Drawings:

1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.

C. Samples:

1. Three full size samples of each tile specified in Drawing Finish Schedule.
2. Grout: Submit manufacturer's full range of standard and designated color samples for each type for Architect's selection.
3. Grout: Submit samples mounted in 6 inches long metal channels for each type and color specified.

D. Project Information:

1. Installation methods.
2. Manufacturer's Certificate: For each shipment, type and composition of tile provide a Master Grade Certificate signed by manufacturer and installer certifying products meet or exceed specified requirements of ANSI A137.1.

E. Contract Closeout Information:

1. Maintenance Data:
   a. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Minimum 10 years of experience in manufacture of tile, setting and grout materials.

B. Installer Qualifications:

1. Specializing in tile work having minimum of 5 years' successful documented experience with work comparable to that required for this Project.

C. Single Source Responsibility:

1. Obtain each type and color tile material required from single source.
2. Provide compatible materials for tile system.

D. Certifications:

1. Submit Master Grade Certificate for each type of ceramic, quarry, and paver tile in accordance with requirements of ANSI A137.1.
2. Submit manufacturer's certifications that mortars, adhesives, and grouts are suitable for intended use.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Ceramic Tile:

1. Base:
    a. See Drawing Finish Schedule.

B. Porcelain Tile:

1. Base:
    a. See Drawing Finish Schedule.

C. Accessories:

1. Base:
    a. Schluter Systems.
2. Option:
    a. Profilitec.

D. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 DESIGN CRITERIA

A. Tile:

1. Ceramic Tile: Comply with ANSI A137.1 American National Standard Specifications for Ceramic Tile for types, compositions, and grades of tile indicated.
2. Porcelain Tile: Comply with ANSI A137.3 American National Tile Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs for types, compositions, and grades of tile indicated.
3. Furnish tile complying with Standard Grade requirements unless otherwise indicated.
4. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

B. Colors, Textures, and Patterns:

1. Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with following requirements:
    a. Match Architect's sample.

C. Factory Mounting:

1. Provide back face or edge mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
2. Do not use back mounted or edge mounted tile assemblies for swimming pools, exterior applications, or wet areas.

D. Grout Release:

1. Factory applied temporary protective coating.
2. Provide where indicated under tile type, protect exposed surfaces of tile against adherence of mortar and grout by pre-coating with a continuous film of petroleum paraffin wax, applied hot.

3. Do not coat unexposed tile surfaces.

2.3 MATERIALS

A. Ceramic Wall Tile:

1. Acceptable Manufacturer: As specified on Drawing Finish Schedule.
2. Grade: ANSI A137.1; 5.0 to 10.0% water absorption.
3. Size, Finish and Color: See Drawing Finish Schedule.

B. Porcelain Wall & Floor Tile:

1. Acceptable Manufacturer: As specified in Drawing Finish Schedule.
2. Porcelain Tile: Porcelain based, impervious unglazed ceramic, through-body color.
3. Water Absorption: Less than 0.1% maximum, ASTM C373..
4. Size, Finish and Color: See Drawing Finish Schedule.

C. Mortar – Thin Set:

1. Portland Cement with Latex Additive:
   a. Latex additive and site mixed Cement mortar.
   b. Comply with ANSI-A118.4.
   c. Acceptable Products:
      1) CustomCrete Latex Mortar Admix with site mixed mortar by Custom Building Products.
      2) Planicrete AC with 4:1 Mud Bed Mix by Mapei.

D. Dryset and Polymer Additive:

1. Description: Two component system; factory prepared second generation high bond strength dry-set mortar and liquid polymer additive; complying with ANSI A118.4.
2. Acceptable Products:
   a. MasterBlend Thin-Set Mortar mixed with CustomFlex Ultra-Strength Thin-Set Additive by Custom Building Products.
   b. MasterBlend Thin-Set Mortar mixed with Acrylic Mortar Admix by Custom Building Products.
   c. VersaBond Bonding Mortar (Dry Polymer) by Custom Building Products.
   d. FlexBond Premium Flexible Bonding Mortar (Dry Polymer) by Custom Building Products.
   e. 4237 Latex Thinset Mortar Additive mixed with 211 Crete Filler Powder by Laticrete.
   f. 3701 Mortar Admix mixed with premium floor and thin set by Laticrete.
   g. Keralastic System consisting of Keralastic polymer additive and Kerabond dry-set mortar by Mapei.
   h. Keraflex Super by Mapei.

E. Unsanded Latex Modified Grout for Wall Tile:

1. Description: Latex-modified, factory blended, mildew resistant, non-sanded, grout consisting of cement and additives; comply with ANSI A118.6.
2. Latex Additive: Type as recommended by latex mortar manufacturer.
3. Color: To be selected.
4. Acceptable Products:
   a. Polyblend Non-Sanded Tile Grout by Custom Building Products.
   b. White Dry Tile Grout by Custom Building Products.
   c. 644 White Dry-Set Grout mixed with 17765 Grout Admix Plus by Laticrete.
   d. 1600 Series Tri-Poly Fortified Non Sanded Grout by Laticrete.

e. Keracolor U polymer-modified unsanded grout by Mapei.

f.

F. Accessories:

1. Fasteners: Corrosion resistant type required by board manufacturer for securing units.
2. Joint Reinforcement Tape: As recommended by board manufacturer.
3. Vapor Retarder:
   a. Comply with ASTM D4397.
   b. Thickness and maximum permeance rating:
      1) 4.0 mils, 0.19 perms.
   c. Vapor retarder tape:
      1) For sealing joints and penetrations in vapor retarder.
      2) Pressure-sensitive type recommended by manufacturer.

G. Joint Sealant:

1. Two component polyurethane sealant, ASTM C920, Type M, self-leveling, for horizontal joints, Type II, non-sag, for vertical joints as specified in Section 07 92 00.
2. Color: Match grout.
3. Sealant:
   a. Chemically compatible with tile, mortar, and grout.
   b. Physically and chemically capable to withstand local environmental conditions.

H. Joint Backing:

1. Closed cell foam polyethylene.
2. .

I. Edge and Transition Strips:

1. Extruded aluminum, or roll-formed stainless steel edge strips, 1/8 inches wide at top edge; height as indicated.
2. Height: As required to suit application.
3. Finish:
   a. Clear-satin anodized aluminum.
   b. Acceptable Products: Schluter - JOLLY

J. Setting Buttons:

1. Plastic buttons of thickness required for joint size indicated to maintain uniform joint width.

K. Penetrating Sealers:

1. Water-based sealer capable of repelling dirt, oil and stains from tile and grout surfaces.
2. Low odor, pH-neutral and non-abrasive.
3. Vapor open, non-film forming.
4. Stain Resistance per Ceramic Tile Institute CTI-072: Excellent.
5. Compatible with tile types scheduled.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. Verify concrete floor surfaces are suitable for tile installation.

1. Firm, dry, clean, and free of oily or waxy films, mortar, and soil.

2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.
3. Verify limits of moisture and alkalinity are within levels tolerated by Tile manufacturer and setting materials manufacturer.
4. Verify areas to receive tile installed by thin bed method have wood float finish, are true within 1/4 inches in 10 feet and are pitched to drains where required.

C. Correct unsatisfactory conditions and proceed with installation only after substrate deficiencies have been corrected and surfaces are acceptable.

D. Start of work constitutes acceptance of surfaces, and waiver of claim that surfaces are unsuitable.

3.2 PREPARATION

A. Prepare surfaces in accordance with manufacturers' instructions for setting materials or additives used.

B. Acid based cleaners are not permitted.

C. Completely remove curing compounds or other substances that would interfere with proper bond of setting materials.

D. Do not seal substrate unless required by manufacturer.

E. Prime substrate when required by manufacturer.

F. Factory Blending:

1. Blend tile in factory and package accordingly so tile are uniform in color range as those throughout packaging and match approved samples.
2. If not factory blended, return to manufacturer or blend tiles at project site before installing.

G. Field Applied Grout Release product, Temporary Protective Coating:

1. Petroleum paraffin wax or proprietary grout release formulation.
2. Provide where specified or required to prevent adhesion or staining of exposed tile surfaces by grout.
3. Precoat exposed surfaces of tile with continuous film of temporary protective coating.
4. Do not coat unexposed tile surfaces.

3.3 INSTALLATION

A. Tile Installation, General:

1. Install tile materials in accordance with ANSI A137.1-2012, ANSI A137.2, ANSI and TCNA specifications, and TCNA Handbook for Ceramic Tile Installation, with exception of more stringent requirements of manufacturer or these Specifications.
2. Cut and fit tile tight to penetrations, protrusions and vertical interruptions and seal.
   a. See Section 07 92 00.
3. Form corners and bases neatly.
4. Install ceramic cove base in accordance with TCNA "Flush" style.
   a. TCNA "Thin-Lip" style installation is not allowed.
5. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size.
6. Ensure nominal grout centerlines are straight.
7. Make joint watertight, without voids, cracks, excess mortar, or grout.
8. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.
   a. Floors
      1) Dry-set on interior slabs on grade: TCNA F113.

b. Walls:
    1) Dry-set on Gypsum Board: TCNA W243.

B. Layout:
1. Lay out work to pattern indicated so full tile or joint is centered on each wall.
    a. Lay out tile to minimize cutting and to avoid tile less than half size.
2. Continue pattern through openings.
3. For heights stated in feet and inches, use courses of full tile to produce nearest attainable heights without cutting tile.
4. Align joints in tile in both directions.
5. Align joints between wall, floor, and base tile.
6. Make joints between sheets of tile same width as joints within sheet.
7. File edges of cut tile smooth and even.
8. Cut and fit tile at penetrations through tile.
9. Grind edges of tile abutting built-in items.
10. Fit tile at outlets, piping, and other penetrations so plates, collars, or covers overlap tile.
11. Extend tile work into recesses and under or behind equipment and fixtures, to form complete covering without interruption, except as otherwise indicated.
12. Accurately form intersections and returns.
13. Form internal corners and external corners square.

C. Thin Set Method, Floors and Walls:
1. Apply mortar or adhesive with notched trowel using scraping motion to work material into contact with surface to be covered.
    a. Maintain 90% coverage on back of tile and fully bed corners.
2. Apply only as much mortar or adhesive as can be covered within time recommended by mortar or adhesive manufacturer.
3. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar or adhesive onto back of each tile or sheet of tiles.
4. Set tiles in place and level surface of tile.
5. Align tile to show uniform joints and set until firm.
6. Clean excess mortar or adhesive from surface of tile while mortar is fresh.
7. Sound tile after setting. Replace hollow sounding tiles.

D. Grouting:
1. Allow tiles to set before grouting.
2. Install in accordance with grout manufacturer's recommendations and ANSI A108.10.
3. Clean excess grout from surface as work progresses.
4. Cure after grouting by covering with kraft or construction paper for 72 hours.
5. Install sealant in vertical wall joints at interior corners.

E. Penetrating Sealer:
1. Surface Preparation:
    a. Verify tile and grout are fully cured.
    b. Verify surfaces are dry, clean, and free of waxes, sealers, and finishes.
    c. Test product in obscure area to produce desirable results.
2. Apply Penetrating Sealer to tiled surfaces, unless otherwise noted.
    a. Application of penetrating sealer is not necessary where epoxy grouts are used.
    b. Apply in accordance with Manufacturer’s instructions.

3. Test after 2 hours by applying drops of water on surface.
    a. If water penetrates, apply an additional coat of sealer.
4. Remove visible residue within 60 minutes after application.

3.4 CLEANING

A. Perform cleaning while mortar is fresh before hardening on surfaces.

B. Wash tile diagonally across joints.

C. Polish with clean dry cloth.

D. Remove grout haze following recommendation of mortar additive manufacturer.

E. Remove residual waxes or grout release agent, temporary protective coatings, by method recommended by coating manufacturer.

1. Confirm acceptability with brick and grout manufacturer.
2. Trap and remove coating to prevent it from clogging floor drains.

3.5 PROTECTION AND REPAIR

A. Prohibit traffic on floor finish for 72 hours after installation.

B. Where temporary use of new floors is unavoidable, supply large, flat boards or plywood panels for walkways over kraft paper.

C. Replace broken, cracked, chipped, stained, or damaged tile.

END OF SECTION

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Acoustical Ceiling Systems (ACT) in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM A641/A641M Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
2. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
3. ASTM B633 Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel
4. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
5. ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panels Ceilings.
6. ASTM C636/C636M Standard Specification for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
7. ASTM D2240 Test Method for Rubber Property - Durometer Hardness
8. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
9. ASTM E413 Classification for Rating Sound Insulation.
10. ASTM E488/E488M Standard Test Methods for Strength of Anchors in Concrete Elements.
11. ASTM E580/E580M Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions
12. ASTM E1264 Standard Classification for Acoustical Ceiling Products.
13. ASTM E1414/E1414M Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum.
14. ASTM E1190 Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

B. Site Classification and Seismic Design Categories as defined in the International Building Code.

1.3 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturer’s literature indicating products comply with specifications.
2. Samples: Three samples of each type of tile listed in Drawing I-001 Interior Notes and Finish Legend.

B. Informational Submittals:

1. Test reports for acoustical performance to include, as applicable:
   a. NRC test reports from test method ASTM C423.
   b. CAC test reports from test method ASTM E1414/E1414M and classification ASTM E413.
   c. STC test reports from test method ASTM E90 and classification ASTM E413.

d. Laboratory and test method accreditation references.

C. Closeout Submittals:

1. Maintenance Data: See Section 01 78 39.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Steel Suspension Systems:

1. Base:
   a. Armstrong World Industries.
2. Optional:
   a. USG Corporation
   b. Chicago Metallic

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 ACOUSTIC SUSPENSION SYSTEMS

A. General Requirements:

1. Heavy duty systems, ASTM C635/C635M.
2. Intermediate duty systems, ASTM C635/C635M.
3. Main runner jointing by spliced, interlocking ends, tab locks, pin locks, or other suitable connections.
4. Cross runners interlocking with main runners.
5. Include components and accessories necessary resist seismic loads and dead loads of items such as light fixtures and air diffusers.
6. Hanger Wire:
   a. Pre-stretched, with a yield stress load of at least 5 times design load, but not less than 0.106 inches (12 GA) .
   b. Utilize continuous lengths, without kinks and splices.
   c. Galvanized Steel:
      1) Galvanized, soft annealed steel wire conforming to ASTM A641/A641M.
7. Attachment Devices:

B. Suspension System Types:

1. Exposed steel grid, non-rated:
   a. Description: Galvanized, double web steel, main and cross runners.
   b. Face width: 15/16 inches .
   c. Base Product:
      1) Refer to Interior Finish Legend.
      2) Prelude XL, by Armstrong.
      3) Donn DX/DXL by USG.
      4) 200 Series by Chicago Metallic.
      5)
   d. Finish on exposed surfaces: Smooth, flat white.
2. Framing and suspension systems for Gypsum Board Ceilings:
   a. Specified in Section 09 22 16.

2.3 ACOUSTICAL CEILING TILE

A. General Requirements:

1. Scheduled finishes to be factory applied.
2. Class A incombustible units.
3. Edges uniformly fabricated, true, square.
4. Sizes as required to fit scheduled suspension system.
5. Standard tile/panel size: See Reflected Ceiling Plan.
6. Concealed spline style: Edges kerfed for splines.
7. Basic Fiberglass Ceiling Tile:
    a. Description: Fiberglass with acoustically transparent membrane and factory-applied latex paint.
    b. Base Product: Optima by Armstrong.
    c. Classification: ASTM E1264, Type XII, Form 2, Pattern E.
    d. Surface Texture: Smooth.
    e. Light Reflectance: Not less than 0.88.
    f. NRC: Not less than 0.95.
    g. Edge: Square.
    h. Thickness: Minimum 1 inches .

A. Diffusers and Grilles: See Section 23 31 00.

B. Light Fixtures: See Section 26 50 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrate to accept installation.

B. Examine installation site for irregularities having effect on quality and execution of work.

C. Consult other trades involved before start of ceiling work, to determine areas of potential interference.

D. Do not start installation until interferences have been resolved.

E. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

A. Coordinate ceiling layout with sprinkler head spacing and work penetrating acoustical ceiling systems.

B. Tolerances:

1. Comply with ASTM C635/C635M Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
2. Deviation from level plane: 1/8 inches in 10 feet with no load applied maximum.
3. Bow: 1/32 inches in 2 feet maximum.
4. Camber: 1/32 inches in 2 feet maximum.
5. Twist: 1 degree in 2 feet maximum.

3.3 INSTALLATION

A. Suspension System:

1. Install suspension system in accordance with manufacturers' instructions.
2. Grid layout:
    a. See Reflected Ceiling Plans.
    b. Install grid based on electrical lighting fixture layout indicated in Electrical Drawings, unless otherwise indicated,

c. Acoustical panel dimension at perimeter walls: Not less than 6 inches .

d.

e. In case of conflict notify Architect.

3. Install grid square with room and with grid or acoustical panel center lines coinciding with center lines of room, each direction.
4. Intersections between main tees and cross tees:
   a. Butt cut and notch as required.
5. Wall angles:
   a. Install wall angles or moldings where ceilings meet walls, partitions, vertical elements, and other types of ceilings or ceiling fixtures.
      1) Secure angles to wall construction at stud locations.
         a) Maximum spacing from terminal ends: 3 inches.
         b) Draw fasteners tight against vertical surfaces.
      2) Level tolerance: not more than 1 in 1000.
      3) Miter cut inside and outside corners.
      4) Install with leg supporting bottom flange of runners.
6. Hanger wires:
   a. Provide hangers and inserts necessary to support ceiling suspension systems and ceiling dead loads.
   b. Coordinate location and alignment with work of other trades.
   c. Install hanger wires plumb to main tees and cross tees.
      1) Do not suspend any part of suspension system from ducts, pipes, conduit, cable tray or equipment.
      2) Provide supplementary rough suspension system where necessary to support ceilings beneath pipes, ducts, equipment, cable trays.
      3) Splay hangers no greater than 30 degrees from vertical to avoid obstructions or other conditions that prevent plumb, vertical installation.
      4) Offset horizontal forces by bracing or counter-splaying.
   d. Space hangers to prevent eccentric deflection and rotation due to loads from items in or on ceiling.
      1) Provide supplemental hangers to support lighting fixtures and within 6 inches from end of main runners and fixtures which exceed manufacturer's published load data.
      2) Do not bear runners on walls or partitions.
7. Main runners:
   a. Utilize wall angles to align and receive terminal ends of main tees without transferring load to wall angle.
   b. Space main tees as indicated to receive lay-in panels and fixtures.
   c. Support terminal ends of main tees by wires located within 6 inches from boundary walls.
8. Cross runners:
   a. Space cross tees as indicated to receive lay-in panels and fixtures.
      1) Install cross runners with positive interlock.
   b. Utilize wall angles to align and receive terminal ends of cross tees without transferring load to wall angle.
   c. Support terminal ends of cross tees by wires located within 6 inches from boundary walls.
9.
10. Leave suspension system ready to accept installation of acoustic materials.

B. Lay-In Items:

1. Install acoustic materials in accordance with manufacturer's instructions.
2. Place lay-in panels, fixtures, diffusers, grilles, and similar items in manner not compromising suspension system performance.
3. Field cut materials to fit grid.
4. Tegular and similar tiles with articulated edges:
   a. Cut edges to match profile of factory edges and paint to match.
5. Ceiling paint:
   a. Touch-up minor surface scratches and blemishes.
   b. Cover field cut edges exposed to view.
   c. Armstrong SuperCoat Ceiling Panel Touch-up Paint.

C. Hold Down Clips:

1. Provide Hold-down-clips at Vestibules.
2. Provide hold down clips if UL rated ceiling requires.

3.4 CLEANING:

A. Clean all surfaces following installation per manufacturer's cleaning instructions.

B. Maintenance per Manufacturer’s finish maintenance instructions.

3.5 PROTECTION:

A. Protect ceilings from damage during the remainder of construction.

B. Finished ceilings shall be without damage. Replace units having scratches, abrasions, or other defects with new units.

END OF SECTION

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SECTION 09 65 13
RESILIENT BASE

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Resilient Base, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
2. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
3. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
4. ASTM F1861 Standard Specification for Resilient Wall Base

B. National Fire Protection Association (NFPA):

1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
2. NFPA 258 Recommended Practice for Determining Smoke Generation of Solid Materials

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.
2. VOC content.

B. Samples:

1. Resilient Base:
   a. Three samples of material and color as specified in Drawing Finish Schedule.
2. Field fabricated corners: Construct sample base inside and outside corner:
   a. Include minimum 4 feet straight base each direction from corner.
   b. If not acceptable, construct additional corners.
   c. Stress whitening and cracking will not be acceptable.
   d. Color and height variation will not be acceptable.
   e. Sample corners constitute standard of quality for actual construction.
   f. Maintain sample corners during construction.
   g. Remove when directed.
   h. Sample corners may be built into permanent construction provided sample area is readily identifiable during construction.
   i. Do not proceed with base installation until sample corners are approved by Architect.

C. Contract Closeout Information:

1. Maintenance data:
   a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Resilient Base:

1. Base:
    a. Armstrong World Industries.
2. Optional:
    a. Mannington.
    b. Endura.
    c. Tarkett.
    d. Roppe.
    e. VPI Floor Products.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Performance Requirements:

1. Thermoplastic Rubber: Type TP.
2. Critical Radiant Flux:
    a. Class I, not less than 0.45 W/cm2.
3. Flame Spread: Maximum, 75.
4. Smoke Developed: Maximum, 250.

B. Resilient Base:

1. Rubber top set, coved type.
2. 1/8 by 4 inches, 1/4 inches wide at bottom.
3. Field formed external and internal corners.
4. Provide continuous rolls, minimum 95 feet long.

C. Resilient Base at carpet:

1. Rubber top set, straight type.
2. 1/8 by 4 inches.
3. Field formed external and internal corners.
4. Provide continuous rolls, minimum 95 feet long.

D. Leveling compound: As recommended by manufacturer, compatible with adhesives.

E. Adhesives and primers:

1. As recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces for defects and irregularities.

B. Verify substrates are free of materials that may affect adhesion.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

D. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

A. Fill cracks, joints, etc., with water resistant non-crumbling patching compound.

B. Trowel to smooth and proper level.

3.3 INSTALLATION

A. Install after wall finishes.

B. Install prior to carpet and acoustical material.

A. Prepare substrate in accordance with manufacturer’s instructions.

B. Protect adjacent work from damage.

C. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.

D. Install base after wall material has dried out thoroughly.

1. Provide base at intersections of floor and vertical surfaces in areas scheduled to receive base, where intersection is exposed to view.
2. Apply primer and adhesive as recommended by manufacturer.
3. Set base straight and true.
4. Fit base neatly into breaks and recesses.
5. Install corners as recommended by manufacturer.
6. Scribe to trim at door frames.
7. Make joints tight.
8. Install with top and bottom edges in firm contact with wall and floor.

3.4 CLEANING

A. Remove surplus adhesive immediately after application and rolling.

B. Clean in accordance with manufacturer's recommendations after materials have sufficiently seated.

END OF SECTION

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SECTION 09 67 81
CONCRETE FLOOR SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Sealer, as indicated, in accordance with provisions of the Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
2. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Contract Closeout Information:

1. Maintenance data:
   a. See Section 01 77 01.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Licensee of or approved in writing by manufacturer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Concrete Floor Sealer:

1. Base:
   a. L&M Construction Chemicals, Laticrete International, Inc.
2. Optional:
   a. Dayton Superior

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Concrete Floor Sealer:

1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
2. Conform to ASTM C1315, Type I, Class A.
3. VOC compliant.
4. Meet local air quality regulations.
5. Minimum Solids Content: 30 percent by volume.
6. Primer: As recommended by manufacturer.
7. Base Product:

a. L&M Dress & Seal WB 30 by Laticrete International, Inc.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Cure concrete as directed by sealer manufacturer.

B. Verify concrete is free of fins, ridges, voids and suitable to accept installation.

C. Examine surfaces to receive sealer. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

D. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

A. Verify curing agents used are compatible with coating system or completely remove.

B. Remove dirt, dust, oil, grease, asphalt, and foreign matter.

C. Patch holes or voids.

D. Rout out cracks exceeding 1/16 inches wide and caulk.

E. Caulk non-moving joints up to 1 inch wide with suitable backer and sealant.

F. Do not caulk or overcoat joints where movement exceeds 25 percent or joints over 1 inch wide.

G. Protect adjacent surfaces not designated to receive curing compound.

3.3 INSTALLATION

A. Do not apply to surfaces scheduled to receive cementitious coatings or toppings, such as concrete, terrazzo, polyester, or epoxy coatings.

B. Apply in accordance with manufacturer's recommendations; minimum 2 coats.

1. Apply first coat at not over 400 square feet/gal.
2. Apply subsequent coat not over 400 square feet/gal.

C. Allow no traffic on sealed surface for 72 hours after application.

3.4 PATCHING AND CLEANING

A. Patch areas which fail to match adjacent work.

B. Broom clean surface after completion of work.

END OF SECTION

SECTION 09 91 10
ARCHITECTURAL PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Surface Preparation.
2. Field application of:
    a. Architectural Coatings.
    b. Special Coatings.
    c. Stains and varnishes.
    d. Any other coating, thinner, accelerator, inhibitor, etc., specified or required as part of a complete System specified in this Specification Section.
3. Environmental controls for field application of coatings.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 03 - Concrete.
2. Division 04 - Masonry.
3. Section 05 52 23 - Steel Railings.
4. Section 08 11 13 – Hollow Metal Doors and Frames.
5. Section 08 14 16 - Flush Wood Doors.
6. Section 09 29 00 - Gypsum Board.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
    a. D523, Standard Test Method for Specular Gloss.
    b. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
    c. D4259, Standard Practice for Abrading Concrete.
    d. D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
    e. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces.
    f. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
    g. F1869, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
    h. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
2. National Fire Protection Association (NFPA):
    a. 101, Life Safety Code.
3. Steel Door Institute/American National Standards Institute (SDI/ANSI):
    a. A250.10, Test Procedure and Acceptance Criteria For Prime Painted Steel Surfaces for Steel Doors and Frames.
4. The Society for Protective Coatings (SSPC):
    a. SP 1, Solvent Cleaning.
    b. SP 2, Hand Tool Cleaning.
    c. SP 3, Power Tool Cleaning.
    d. SP 16, Brush-off Blast Cleaning of Non-Ferrous Metals.

5. The Society for Protective Coatings/NACE International (SSPC/NACE):
    a. SP 6/NACE No. 3, Commercial Blast Cleaning.
    b. SP 7/NACE No. 4, Brush-off Blast Cleaning.
    c. SP 13/NACE No. 6, Surface Preparation of Concrete.
6. United States Environmental Protection Agency (EPA).

B. Miscellaneous:

1. Coating used in all corridors and stairways shall meet requirements of NFPA 101 and ASTM E84.

1.3 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

B. Approved Factory Finish: Finish on a product in compliance with the finish specified in the Specification Section where the product is specified.

C. Exposed Exterior Surface:

1. Exterior surface which is exposed to view.
2. Exterior surface which is exposed to weather but not necessarily exposed to view.

D. Finished Area:

1. An area that is listed in or has finish called for on Room Finish Schedule.
2. An area that is indicated on Drawings to be painted.

E. Gloss Range:

1. Specular gloss measured in accordance with ASTM D523:
    a. Flat: Below 15, at 60 degrees.
    b. Eggshell: Between 20 and 35, at 60 degrees.
    c. Semi-gloss: Between 35 and 70, at 60 degrees.
    d. Gloss: More than 70, at 60-degrees.

F. Paint includes the following:

1. Architectural paints (AP) include: Acrylic latex or alkyd enamel coatings.
2. Special coatings (SC) include: Water-based pigmented resin particles suspended in acrylic latex solution.
3. Stains and varnish include: Alkyd stain and polyurethane varnish.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's surface preparation instructions.
    c. Manufacturer's application instructions.

B. Samples:

1. Manufacturer's full line of colors for Engineer's preliminary color selection.
2. Gloss samples.
3. After preliminary color selection by Engineer provide two (2) 8 by 10 inches samples of each final color and sheen selected.

C. Informational Submittals:

1. Test results.
2. Applicator's daily records:
    a. Submit daily records at end of each week in which painting work is performed unless requested otherwise by Engineer's on-site representative.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:

1. Name or type number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels.
5. VOC content.

B. Store materials in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 degrees F.

1.6 PROJECT CONDITIONS

A. Verify that atmosphere in area where painting is to take place is within paint manufacturer's acceptable temperature, humidity and sun exposure limits.

1. Provide temporary heating, shade and/or dehumidification as required to bring area within acceptable limits.
    a. Provide temporary dehumidification equipment properly sized to maintain humidity levels required by paint manufacturer.
    b. Provide clean heat with heat exchanger type equipment sufficient in size to maintain temperature on a 24 hour basis.
        1) Vent exhaust gases to exterior environment.
        2) No exhaust gases shall be allowed to vent into the space being painted or any adjacent space.
2. Do not apply coatings in snow, rain, fog or mist.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products from a single manufacturer to the greatest extent practicable.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Architectural paints:
    a. Benjamin Moore & Co.
    b. PPG.
    c. Pratt & Lambert.
    d. Sherwin-Williams.
    e. Tnemec, Inc.
2. Special coatings:
    a. Master Coating Technologies, Inc. - Zolatone.
    b. Dryvit Systems, Inc.
3. Stains and varnish:
    a. Benjamin Moore & Co.
    b. PPG IdeaScapes.

c. Pratt & Lambert.
d. Sherwin-Williams.

2.2 MATERIALS

A. General:

1. For unspecified materials such as thinner, provide manufacturer's recommended products.
2. Unless noted otherwise, products listed are manufactured by the manufacturer listed below.
   a. Products of other manufacturers will be considered for use provided that the product:
      1) Is of the same generic formulation.
      2) Has comparable application requirements.
      3) Meets the same VOC levels or better.
      4) Provides the same finish and color options.
3. Coatings shall comply with the VOC limits of EPA
4. Colors:
   a. Colors and gloss will be selected from the manufacturer’s complete offering, including special colors and premium offerings.

B. Architectural Paints:

1. Product List:

Generic Description	Product
Acrylic Primer	PPG Pure Performance 9-900
Acrylic Latex	PPG Pure Performance 9-100/9-300/9-500 Series
Acrylic Gloss	PPG Speedhide 6-8534 Series
Concrete Filler/Surfacer	Tnemec Series 215 and/or Series 218
CMU Block Filler	Tnemec Series 54 Masonry Filler
Dry-Fall Primer	Tnemec Series V115 Uni-Bond DF
Epoxy Barrier Coat	Tnemec Series 135 Chembuild
Fluoropolymer	Tnemec Series 1070V/1071V/1072V Fluoronar
HDP Acrylic	Tnemec Series 1028/1029 Enduratone
Organic Zinc Primer	Tnemec Series 94-H2O Hydro-Zinc
Polycarbamide	Tnemec Series 740/750 UVX
Waterborne Acrylate	Tnemec Series 156 Enviro-Crete

C. Special Coatings:

1. Product List:

Generic Description	Product
Special Coating Acrylic Primer	Zolatone SP203 Acrylic Basecoat.
Special Coating Stain Blocker	Zolatone SP222 Eco-Block.
Special Coating Base Coat	Zolatone Flex Base Coat.
Special Coating Finish Coat	Zolatone Flex Finish Coat.

D. Stains and Varnishes:

1. Product List:

Generic Description	Product
Sanding sealer	PPG Olympic 41061 Premium Interior Water Based Sanding Sealer
Alkyd Wood Stain	PPG Olympic 44500 Premium Interior Oil Based Wood Stain
Polyurethane Varnish	PPG Olympic 42786 Premium Interior Water Based Polyurethane Clear Satin

2.3 PAINT SYSTEMS

A. Schedule:

Substrate	Prime Coat[1]	Intermediate Coat(s)[1]	Finish Coat[1]
Concrete	Concrete Filler/Surfacer as necessary to fill all voids and depressions	100 to 200 square feet/GAL Waterborne Acrylate	100 to 200 square feet/GAL Waterborne Acrylate
Concrete Masonry	80 to 100 square feet/GAL CMU Block Filler	100 to 200 square feet/GAL Waterborne Acrylate	100 to 200 square feet/GAL Waterborne Acrylate
Structural Steel and Miscellaneous Metals[3]	2.5 to 3.5 mil Organic Zinc Primer	2.0 to 3.0 mil HDP Acrylic[2]	2.0 to 3.0 mil HDP Acrylic[2]
Galvanized Structural Steel and Miscellaneous Metals[3]	2.0 to 4.0 mil Dry-Fall Acrylic	XX	2.0 to 3.0 mil HDP Acrylic [2]
Galvanized Metal Deck[3]	2.0 to 4.0 mil Dry-Fall Acrylic	XX	2.0 to 4.0 mil Dry-Fall Acrylic
Factory Primed Metal Deck[3]	XX	2.0 to 4.0 mil Dry-Fall Acrylic	2.0 to 4.0 mil Dry-Fall Acrylic
Galvanized Steel Railings	4.0 to 6.0 mil Epoxy Barrier Coat	2.5 to 3.5 mil Polycarbamide Gloss	2.5 to 3.5 mil Polycarbamide Gloss
Steel Railings	4.0 to 6.0 mil Epoxy Barrier Coat	2.0 to 3.0 mil HDP Acrylic Gloss	2.0 to 3.0 mil HDP Acrylic Gloss
Exposed wood indicated to be painted	300 to 400 square feet/GAL Acrylic Primer	300 to 400 square feet/GAL Acrylic Gloss	300 to 400 square feet/GAL Acrylic Gloss
Exposed wood indicated to be stained	400 to 500 square feet/GAL Sanding Sealer	Two coats at 400 to 500 square feet/GAL Alkyd Wood Stain	Two coats at 400 to 500 square feet/GAL Polyurethane Varnish
Hollow Metal - Interior	4.0 to 5.0 mil DFT Epoxy Barrier Coat	2.0 to 3.0 mil HDP Acrylic[2]	2.0 to 3.0 mil HDP Acrylic[2]
Hollow Metal - Exterior	4.0 to 5.0 mil DFT Epoxy Barrier Coat	2.5 to 3.5 mil Polycarbamide[2]	2.5 to 3.5 mil Polycarbamide[2]
Sectional Overhead Doors	4.0 to 5.0 mil DFT Epoxy Barrier Coat	XX	2.0 to 3.0 mil DFT Fluoropolymer[2]
Gypsum Board scheduled to receive "AP"	300 to 400 square feet/GAL Acrylic Primer	300 to 400 square feet/GAL Acrylic Latex [2]	300 to 400 square feet/GAL Acrylic Latex [2]

Gypsum Board scheduled to receive "SC"	250 to 350 square feet/GAL Special Coating Acrylic Primer	250 to 300 square feet/GAL Special Coating Base Coat	125 to 150 square feetGAL Special Coating Finish Coat

1. Application rates (SF/GAL) shown are for unthinned materials.
2. Sheen as scheduled or selected.
3. For steel elements to receive fireproofing, see Specification Section 07 81 00.

PART 3 - EXECUTION

3.1 ITEMS TO BE PAINTED

A. Exterior surfaces, including but not limited to:

1. Concrete:
   a. Where indicated on Drawings.
2. Concrete masonry:
   a. Where indicated on Drawings.
3. Structural steel:
   a. Columns, beams and bracing.
   b. Field welded connections of factory painted structural steel.
4. Steel railings.
5. Galvanized steel railings.
6. Miscellaneous ferrous metal surfaces:
   a. Items specifically noted on Drawings to be painted.
7. Miscellaneous galvanized steel surfaces:
   a. Pipe Bollards.
   b. Embed Plates.
   c. Loose lintels.
   d. Steel components of concrete lintels.
   e. Items specifically noted on Drawings to be painted.
8. Doors and frames:
   a. Hollow metal doors and frames.
   b. Hollow metal window frames.

B. Interior Areas:

1. Refer to Room Finish Schedule on Drawings.
   a. If space is scheduled to be painted, paint all appurtenant surfaces within the space unless specifically noted otherwise.
   b. Provide coating manufacturer’s recommended bonding primer.
   c. Appurtenant surfaces include but are not limited to:
      1) Columns, beams, bracing and similar components.
      2) Underside of roof or floor decks above.
      3) Conduit, boxes, covers and supports.
      4) Ductwork, duct insulation and duct supports.
      5) Piping, pipe insulation and jacketing.
      6) Miscellaneous ferrous metal surfaces.
2. Concrete walls and columns.
3. Concrete masonry.
4. Doors and frames:
   a. Hollow metal doors and frames

b. Hollow metal window frames.
c. Four-fold industrial doors.
d. Sectional overhead doors.

3.2 ITEMS NOT TO BE PAINTED

A. General: Do not paint items listed in this Article, unless noted otherwise.

B. Items with Approved Factory Finish: These items may require repair of damaged painted areas or painting of welded connections.

C. Electrical equipment.

D. Moving parts of mechanical and electrical units where painting would interfere with the operation of the unit.

E. Code labels, equipment identification or rating plates and similar labels, tagging and identification.

F. Contact surfaces of friction-type structural connections.

G. Stainless steel surfaces.

H. Aluminum Surfaces Except:

1. Where specifically shown in the Contract Documents.
2. Where in contact with concrete.
3. Where in contact with dissimilar metals.
4. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

I. Fiberglass Surfaces Except:

1. Fiberglass piping where specifically noted to be painted.
2. Piping supports where specifically noted to be painted.
3. Appurtenant surfaces as described in the ITEMS TO BE PAINTED article.

J. Galvanized steel items, unless specifically noted to be painted.

K. Architectural finishes:

1. Exterior concrete indicated to receive another finish.
2. Precast concrete surfaces, unless specifically indicated to be painted.
3. Prefinished masonry surfaces:
   a. Precolored masonry (exterior face).
      1) Interior face shall be painted where scheduled.
   b. Burnished (ground face) concrete masonry.
   c. Prefaced masonry.
   d. Face brick.
   e. Glass masonry.
4. Plastic laminate.
5. Solid surface material.
6. Standing and running trim.
7. Fiberglass fabrications.
8. Anodized aluminum.
9. PVDF coated metals.
10. Factory finished doors and frames.
11. Aluminum windows, curtainwall and storefront framing systems.
12. Finish hardware.

13. Glass and glazing.
14. Ceramic, porcelain, quarry tile or natural stone.
15. Acoustical materials.
16. Building specialties.
17. Louvers.
18. Casework and countertops.
19. Pipe insulation and jacketing.
20. Standing seam metal roof, fascia, trim, soffit and accessories.

3.3 EXAMINATION

A. Concrete:

1. Test pH of surface to be painted in accordance with ASTM D4262.
    a. If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable range.
    b. Retest pH until acceptable results are obtained.
2. Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.
    a. Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.
        1) If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.
        2) Provide remedial measures as necessary to bring moisture content within paint manufacturer’s recommended acceptable limits.
        3) Retest surface until acceptable results are obtained.

B. Concrete Unit Masonry:

1. Test pH of surface to be painted in accordance with ASTM D4262.
    a. If surface pH is not within paint manufacturer's required acceptable range, use methods acceptable to paint manufacturer as required to bring pH within acceptable limits.
    b. Retest pH until acceptable results are obtained.
2. Verify that moisture content of surface to be painted is within paint manufacturer's recommended acceptable limits.
    a. Test surface to be coated in accordance with ASTM D4263 to determine the presence of moisture.
        1) If moisture is detected, test moisture content of surface to be coated in accordance with ASTM F1869.
        2) Provide remedial measures as necessary to bring moisture content within paint manufacturer’s recommended acceptable limits.
        3) Retest surface until acceptable results are obtained.

3.4 PREPARATION

A. General:

1. Prepare surfaces to be painted in accordance with paint manufacturer's instructions and this Specification Section unless noted otherwise in this Specification Section.
    a. Where discrepancy between paint manufacturer's instructions and this Specification Section exists, the more stringent preparation shall be provided unless approved otherwise, in writing, by the Engineer.
2. Remove all dust, grease, oil, compounds, dirt and other foreign matter which would prevent bonding of paint to surface.
3. Adhere to manufacturer's recoat time surface preparation requirements.

a. Surfaces that have exceeded paint manufacturer's published recoat time and/or have exhibited surface chalking shall be prepared prior to additional paint in accordance with manufacturer's published recommendations.

B. Protection:

1. Protect surrounding surfaces not to be coated.
2. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items; or provide ample in-place protection.
3. Protect code labels, equipment identification or rating plates and similar labels, tagging and identification.

C. Prepare and paint before assembly all surfaces which are inaccessible after assembly.

D. Existing Surfaces:

1. Wherever existing work is cut, patched or modified; repair and repaint to match new work.
2. Where a wall or ceiling is disturbed and patched, paint entire wall or ceiling.

E. Wood:

1. Sandpaper smooth, remove dust.
2. Opaque Finishes:
   a. Seal all knots, pitch and resinous sapwood after prime coat has dried.
   b. Putty holes and imperfections; sand smooth.
3. Transparent Finishes:
   a. Treat wood with compatible wash-coat prior to stain application.
   b. Putty holes and imperfections to match wood color; sand smooth.

F. Ferrous Metal:

1. Complete fabrication, welding or burning before beginning surface preparation.
   a. Chip or grind off flux, spatter, slag or other laminations left from welding.
   b. Remove mill scale.
   c. Grind smooth rough welds and other sharp projections.
2. Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.
3. Exterior exposure:
   a. Commercial blast clean in accordance with SSPC SP 6/NACE No. 3.
4. Interior exposure:
   a. Hand tool cleaning in accordance with SSPC SP 2 and/or power tool cleaning in accordance with SSPC SP 3.

G. Hollow Metal:

1. Solvent clean in accordance with SSPC SP 1 to remove all dust, grease, oil, compounds, dirt and other foreign matter.
2. Lightly sand primed surfaces with fine grit sandpaper as recommended by hollow metal manufacturer.

H. Galvanized Steel and Non-ferrous Metals:

1. Solvent clean to remove all dust, grease, oil, compounds, dirt and other foreign matter.
2. Brush-off blast in accordance with SSPC SP 16 or hand tool cleaning in accordance with SSPC SP 2 to remove surface contaminants.

I. Gypsum Wallboard:

1. Repair minor irregularities left by finishers.
2. Avoid raising nap of paper face on gypsum wallboard.

3. Verify moisture content is less than 8% before painting.
4. After application of prime coat and between subsequent coats, inspect surface and repair holes, dents, irregularities or other defects as necessary to provide a smooth, uniform finish.

J. Concrete:

1. Cure for minimum of 28 days.
2. Clean in accordance with ASTM D4258.
   a. Remove all soil, grease, oil, or other surface contaminants.
3. Grind fins and protrusions in accordance with ASTM D4259, flush to plane of wall.
4. Abrasive blast in accordance with ASTM D4259 and SSPC SP13/NACE No. 6.
   a. Remove all laitance, efflorescence, scabbing and other foreign matter.
   b. Provide minimum concrete surface profile CSP 3 per ICRI 310.2.
5. Test pH and moisture content in accordance with EXAMINATION article in this specification section.
6. Repair tie holes, voids, bugholes or other surface defects as necessary to provide smooth, uniform surface.

K. Concrete Unit Masonry:

1. Cure for minimum of 28 days.
2. Remove all mortar spatters and protrusions.
3. Clean in accordance with ASTM D4261.
   a. Remove all soil, grease, oil, efflorescence.
4. Test pH and moisture content in accordance with EXAMINATION article in this specification section.

3.5 APPLICATION

A. General:

1. Thin, mix and apply paints in accordance with manufacturer's installation instructions.
   a. Where discrepancy exists between manufacturer’s instructions and this Specification Section, the more stringent requirement shall apply.
   b. When materials have been thinned, adjust application rates as necessary to achieve film coverage indicated in Part 2 for unthinned materials.
   c. Backroll spray applied paints.
2. Temperature and weather conditions:
   a. Do not paint surfaces when surface temperature is below 50 degrees F unless product has been formulated specifically for low temperature application and application is approved in writing by Engineer and paint manufacturer's authorized representative.
   b. Avoid painting surfaces exposed to hot sun.
   c. Do not paint on damp surfaces.
3. Apply materials under adequate illumination.
4. Evenly spread to provide full, smooth coverage.
   a. All paint systems are "to cover."
      1) When color or undercoats show through, apply additional coats until paint film is of uniform finish and color.
   b. Finished paint system shall be uniform and without voids, bugholes, holidays, laps, brush marks, roller marks, runs, sags or other imperfections.
5. If so directed by Engineer, do not apply consecutive coats until Engineer has had an opportunity to observe and approve previous coats.
6. Work each application of material into corners, crevices, joints, and other difficult to work areas.

7. When painting rough surfaces, hand brush and backroll paint to work into all recesses.
8. Smooth out runs or sags immediately, or remove and recoat entire surface.
9. Allow preceding coats to dry before recoating.
    a. Recoat within time limits specified by paint manufacturer.
    b. If recoat time limits have expired re-prepare surface in accordance with paint manufacturer's printed recommendations.
10. Allow coated surfaces to cure prior to allowing traffic or other work to proceed.
11. Finish colors not otherwise indicated shall be selected by Engineer from paint manufacturer’s complete offering.

B. Fillers, surfacers or patching compounds:

1. Provide fillers, surfacers or patching compounds in accordance with manufacturer’s recommendations and as specified herein as necessary to provide a smooth, defect free substrate.

C. Prime Coat Application:

1. Prime all surfaces indicated to be painted.
    a. Apply prime coat in accordance with paint manufacturer's written instructions and as written in this Specification Section.
2. Ensure field-applied paints are compatible with factory-applied paints or existing coatings.
    a. Employ services of coating manufacturer's qualified technical representative.
        1) Certify through material data sheets.
        2) Perform test patch.
    b. If field-applied coating is found to be not compatible, require the coating manufacturer's technical representative to recommend, in writing, product to be used as barrier coat, thickness to be applied, surface preparation and method of application.
    c. At Contractor's option, coatings may be removed, surface re-prepared, and new coating applied using appropriate paint system listed in the MATERIALS Article, Paint Systems paragraph of this Specification Section.
        1) All damage to surface as result of coating removal shall be repaired to original condition or better by Contractor at no additional cost to Owner.
3. Special coatings prime coat application:
    a. Prime new gypsum board surfaces using sealer as recommended by manufacturer.
        1) Apply at rate per manufacturer’s recommendation.
    b. Prime and fill new concrete and masonry using sealer coat as recommended by manufacturer followed by modified epoxy filler as specified.
    c. Prime filled concrete and masonry surfaces with primer at rates and as recommended by manufacturer.
4. Back prime all wood scheduled to be painted, prior to installation.
5. Touch up damaged primer coats prior to applying finish coats.
    a. Restore primed surface equal to surface before damage.

D. Finish Coat Application:

1. Apply finish coats in accordance with paint manufacturer's written instructions and in accordance with this Specification Section.
2. Touch up damaged finish coats using same application method and same material specified for finish coat.
    a. Prepare damaged area in accordance with the PREPARATION Article of this Specification Section.
3. Hollow metal frames and doors:
    a. Finish coats shall be spray applied only.

b. Finish edges same as faces of doors.

4. Varnish:
   a. Apply first coat of varnish: Gloss.
      1) Allow to dry a minimum of 48 hours.
   b. Apply second and third coats of varnish: Satin.
      1) Allow a minimum of 48 hours between each coat.
   c. Lightly sand between coats as required and remove dust.

3.6 FIELD QUALITY CONTROL

A. Application Deficiencies:

1. Surfaces showing runs, laps, brush marks, telegraphing of surface imperfections or other defects will not be accepted.
2. Surfaces showing evidence of fading, chalking, blistering, delamination or other defects due to improper surface preparation, environmental controls or application will not be accepted.

B. Provide protection for painted surfaces.

1. Surfaces showing soiling, staining, streaking, chipping, scratches, or other defects will not be accepted.

C. Maintain Daily Records:

1. Record the following information during application of each coat of paint applied:
   a. Date, starting time, end time, and all breaks taken by painters.
   b. For exterior painting:
      1) Sky condition.
      2) Wind speed and direction.
   c. Air temperature.
   d. Relative humidity.
   e. Moisture content and surface temperature of substrate prior to each coat.
   f. Provisions utilized to maintain work area within manufacturer's recommended application parameters including temporary heating, ventilation, cooling, dehumidification and provisions utilized to mitigate wind blown dust and debris from contaminating the wet paint film.
   g. Record environmental conditions, substrate moisture content and surface temperature information not less than once every four (4) hours during application.
      1) Record hourly when temperatures are below 50 degrees F or above 100 degrees F.
2. Record the following information daily for the paint manufacturer's recommended curing period:
   a. Date and start time of cure period for each item or area.
   b. For exterior painting:
      1) Sky conditions.
      2) Wind speed and direction.
   c. Record environmental conditions not less than once every 12 hours.
      1) Record once every 4 hours when ambient temperature is below 35 degrees F.
   d. Provisions utilized to protect each item or area and to maintain areas within manufacturer's recommended curing parameters.
3. Format for daily record to be computer generated.

D. Measure surface temperature of items to be painted with surface temperature gage specifically designed for such.

E. Measure substrate humidity with humidity gage specifically designed for such.

F. Provide wet paint signs.

3.7 CLEANING

A. Clean paint spattered surfaces.

1. Use care not to damage finished surfaces.

B. Remove masking, adhesive residue or other foreign materials.

C. Upon completion of painting, replace hardware, accessories, plates, fixtures, and similar items.

D. Remove surplus materials, scaffolding, and debris.

3.8 COLOR SCHEDULE

Color Tag	Manufacturer	Color Number	Color Name	Sheen
AP-1	PPG	PPG14-26	Hideaway	Eggshell
AP-2	PPG	PPG1014-1	Glacial Ice	Semi-Gloss
SC-1	Zolatone			N/A
SC-2	Zolatone			N/A
ST-1	PPG Olympic			N/A
ST-2	PPG Olympic			N/A

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DIVISION 10

SPECIALTIES

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SECTION 10 14 03
IDENTIFICATION DEVICES - EXTERIOR

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services required for fabrication and installation of Identification Devices as indicated in the Drawings and described in this Section.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. UL listed light fixtures and electrical components.

B. Provide fabrication drawings engineered to support dead, live, lateral (wind or seismic), and snow or ice loads indicated for mechanically mounted or anchored identification devices.

1. Comply with Section 01 71 23, Field Engineering Requirements.
2. Include seal and signature of engineer licensed in the state where project is located.

C. Permits:

1. Secure exterior signage permits based on the local codes and regulations.
2. Notify Architect to resolve design limitations based on code restrictions.

1.3 SUBMITTALS

A. Product Data:

1. For each type of material and accessory.

B. Shop Drawings:

1. Fabrication and installation drawings for identification device types.
    a. Scaled drawings of major components.
    b. Demonstrate load capacity of components by labeling or calculations.
    c. Include dimensioned plans, elevations, and scaled details of identification device wording and lettering layout.
2. Field verify dimensions and locations for identification device types prior to developing shop drawings.
3. Furnish location template drawings for items supported or anchored to permanent building construction.

C. Samples:

1. Scaled print of each identification device (sign type).
2. Minimum 6 inches x 6 inches sample of materials for identification device types.

D. Project Information:

1. Engineering design details and calculations for identification device material components, gauges, footings, anchors with applicable design loads noted, sealed by registered Engineer (licensed to practice Structural Engineering in the state where project is located) for identification devices requiring footings, foundations, and structural support, including identification device types mounted on exterior of building.
    a. Include plans, and elevations.
    b. Indicate accessory items and anchorages.
    c. Design in accordance with Local Building Codes.

E. Contract Closeout Information:

1. Operation and Maintenance Data.
    a. See Section 01 77 01.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Identification Devices - Exterior:

1. Base:
    a. Trademark Visual.
2. Optional:
    a. Poblocki Sign Company.
    b. ASI Sign Systems.
    c. Jones Sign.
    d. DCL (Design Communication Ltd.)
    e. L&H Sign Company

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Identification Devices:

1. Following information is shown on Drawings for each sign type:
    a. Individual component and accent materials.
    b. Letter style, case, and height.
    c. Character proportions.
    d. Letter colors.
    e. Background color and other graphics.
    f. Mounting method and shims or spacers used.
    g. Location of sign relative to other building elements.
    h. Finish level.
2. Direction and identification devices for communications systems: International Symbols.

B. Identification Device Finish Level:

1. High Finish:
    a. May include following materials, or combination of materials:
        1) Back-painted, sandblasted glass panel with silkscreened letters.
        2) Etched, paint-filled letters.
        3) Etched stainless steel panel.
        4) LED digital matrix display.
        5) Painted aluminum letters.
        6) Painted aluminum panel.
        7) Painted die-cut graphic film letters.
        8) Water-jet cut stainless steel letters.
2. Finish and Contrast:
    a. Characters and background:
        1) Non-glare.
        2) 70% contrast between characters with background.

C. Materials:

1. Inert.

2. Materials listed establish the minimum acceptable quality, size, and performance. Equivalent or superior materials will be allowed. Acceptance of alternate materials will be determined in the submittal process.

D. Dissimilar Metals Protection:

1. Prevent galvanic reactions between products used.

E. Aluminum:

1. Sheet:
   a. Alloy and temper recommended by aluminum manufacturer for type of use, and finish indicated.
   b. Provide with minimum strength and durability in accordance with ASTM B209, Table for 5052 for thickness specified.
2. Extrusions:
   a. Alloy and temper recommended by aluminum manufacturer for the type of use, and finish indicated.
   b. Provide with minimum strength and durability in accordance with ASTM B221, Table for 6061 for thickness indicated.
3. Castings:
   a. Alloy and temper for use and finish indicated as recommended by aluminum manufacturer for casting process used.
4. Anodized:
   a. Mill produced 5005 alloy, anodized quality aluminum.
   b. Coating: Clear, anodized coating, 0.2 mil thick.

F. Paints:

1. Apply paint under-coating for identification devices for deterioration of metals prevention.
2. Evenly spray apply finish in accordance with manufacturer's recommendation.
   a. Finish to be free of grit, dirt, smears, spots, and orange peel effect.
   b. Ensure paint compatible with metal used.
3. Each coat shall have UV Inhibitors
4. Manufacturer: Matthews Paint Company, Pleasant Prairie, WI.

G. Fasteners and Anchors:

1. Anchors and inserts:
   a. Exterior installations, and areas requiring corrosion resistance:
      1) Non-ferrous metal, or hot-dipped galvanized anchors and inserts.
   b. Concrete and masonry work: Toothed steel, or lead expansion bolt devices with inserts for drilled-in-place anchors.
2. Bracket mounting:
   a. Identification devices which project at right angles from walls or ceilings.
      1) Manufacture's recommended standard concealed brackets, fittings, and hardware.
      2) Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices in accordance with manufacturer's recommendations.
3. Mount cast plaques using standard method recommended by manufacturer for each type of wall surface.
4. Concealed mounting:
   a. Insert threaded studs into tapped lugs on back of plaque.
   b. Set in predrilled holes filled with quick setting cement.
5. Mount plaques with exposed fasteners anchored through face of plaque into wall surface.

6. Flush mounting: Letters mounted with backs in contact with wall surface.
7. Glass mounting: When mounting identification device panels to front surface of glass, provide 0.080 inches aluminum backup plate, on inside surface of glass.
8. Magnetic tape:
    a. Manufacturer: 3M.
9. Mechanical fastening: Manufacturer's recommended fasteners based on identification device type and substrate.
10. Metal letters and numbers:
    a. Manufacturer's standard fastening method for letter form, type of mounting, wall construction, and condition of exposure.
    b. Heavy paper template: Provided by Manufacturer for establishing letter spacing and for locating holes for fasteners.
11. Projected mounting: Mount letters at a projected distance from the wall surface as indicated.
12. Reclosable fasteners:
    a. Manufacturer: 3M.
    b. Fastener types.
        1) Dual Lock SJ3562, Type 170.
        2) Dual Lock SJ3560. Type 250.
        3) Dual Lock SJ3561, Type 400.
    c. Provide fastener types as recommended by manufacturer.
13. Shim plate mounting:
    a. Concealed aluminum shim plates 1/16 inches thick, with predrilled and countersunk holes.
    b. Provide at locations indicated, and where other mounting methods are not practicable.
    c. Attach shim plate with fasteners and anchors providing secure attachment to substrate.
    d. Attach panel identification devices to shim plate and substrate.
14. Wall mounting: Attach panel identification devices to wall surfaces using following methods:
    a. Tape mounting: Double-sided foam tape, thickness indicated, or as required to mount identification devices to smooth, non-porous surfaces.
    b. Silicone adhesive mounting:
        1) Liquid silicone adhesive recommended by Manufacturer for attaching identification devices to irregular, porous, or graphic film-covered surfaces.
15. Installer requirements:
    a. Based on manufacturer recommendations, installer shall be responsible for fastener compatibility with substrates.
    b. Insure that oxidation does not occur, or that other reactive processes do not occur between related signage materials and fasteners.

H. Adhesives:

1. Permanent adhesive:
    a. Manufacturer: 3M.
    b. Scotch 468MP, hi-performance adhesive, or as recommended by manufacturer.
2. Silicone adhesive:
    a. Manufacturer: Momentive.
    b. Type: Silicone paneling adhesive as recommended by manufacturer.
3. Double faced laminating film:
    a. Manufacture: Fasson, Division of Avery International Company.
    b. Type: FASTAPE A Laminating Film, or as recommended by manufacturer.

4. Permanent double faced tape:
    a. Manufacturer: 3M.
    b. Type: 1/32 inches, Scotch Mount Neoprene Tape No. 4962, or as recommended by manufacturer.
5. Removable double faced tape:
    a. Manufacturer: 3M.
    b. Type: 1/32 inches, double faced removable tape No. 4432, or as recommended by manufacturer.
    c. Color: Black.
6. Installer ensure adhesive compatibility with substrates.

I. Finishes:

1. Glass: Non-glare.
2. Metal finishes: Finish in compliance with NAAMM Metal Finishes Manual for finish designations and application recommendations.
3. Paint: Satin finish.
4. Stainless steel: ANSI No. 4 finish, horizontal grain, unless otherwise noted or specified.
5. Comply with American with Disabilities Act:
    a. Measure finishes with a Glossimeter to ensure compliance.

J. Graphics:

1. Image Process:
    a. Graphic content and style:
        1) Provide identification device copy in compliance with requirements indicated for content, finishes, materials, positions, sizes, spacing, styles, and colors of letters, numbers, symbols, and other graphic images.
2. Typography:
    a. Typography and graphics:
        1) Photographically or mechanically reproduced.
    b. International Symbols:
        1) In accordance with U.S. Department of Transportation current standards publication.
    c. Identification device typeface fonts:
        1) Provide as indicated on Drawings.
    d. Letter forms:
        1) Use approved type font masters from original type foundry.
        2) Cut letter forms using graphic film cutter plotter equipment.
        3) Letter forms edges and corners are to be clean and true.

K. Artwork:

1. Manufacturer provides typesetting, and mechanical artwork required for identification device types.

2.3 FABRICATION

A. General Requirements:

1. Fabricate and assemble identification devices in shop to the greatest extent possible.
2. Fabricate parts and assemblies ready for installation at the building site.
3. Surface defects considered unacceptable: Oil canning, cupping, and warping.
4. Grind welds smooth.
5. Be responsible for structural stability and mounting for graphics and identification devices.

B. Identification Device Panels:

1. Comply with requirements indicated for colors, designs, details of construction, finishes, materials, shapes, sizes, and thicknesses.
2. Surfaces: Smooth, even, and level.
3. Identification device panel flatness:
    a. Fabricate panels to remain flat within 1/32 inches over the concave surface.
    b. Fabricate panels to remain flat under installed conditions within a tolerance of plus or minus 1/16 inches measured diagonally.
4. Edge Condition: 90 degree square cut, unless otherwise noted.
5. Corner condition: Provide square corners, unless otherwise noted.
6. Panel materials:
    a. See drawings for types and locations.

C. Fabricated Metal Letters and Numbers:

1. Fabricate metal letters and numbers in sizes and styles indicated.
    a. Thicknesses: As indicated.
    b. Form exposed faces and sides of characters.
    c. Produce surfaces free from warp and distortion.
    d. Provide internal bracing for stability.
    e. Provide internal bracing for attachment of required mounting accessories.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions under which materials are to be installed.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. General Requirements:

1. Locate identification devices and accessories where shown or scheduled in AG-Series drawings.
2. Use mounting method types indicated and as described, and in accordance with manufacturer's recommendations.
3. Field determine exact locations and dimensions for identification devices prior to fabrication.
4. Immediately notify Owner and Architect if building and site conditions are at variance with drawings.
    a. Do not proceed until the unsatisfactory conditions have been corrected.
5. Install identification devices in positions shown on drawings.
    a. Install identification devices at heights indicated, plumb, and in alignment.
    b. Brace devices securely until permanent anchorage is made.
    c. Identification device surfaces are to be installed free from distortion or other defects in appearance.
    d. Perform cutting, drilling, and fitting carefully.
    e. When required, fit at site before finishing.

B. Mount identification devices according to methods specified or as indicated on drawings for each type.

C. Manufacturer to provide printed instructions or drawings on wall blocking locations and type required to Signage Contractor in a timely manner to allow installation.

3.3 CLEAN-UP

A. At completion of the installation, clean identification devices with appropriate cleaning agents prior to final inspection and acceptance. Grease, fingerprints, smudges, adhesive, etc. remaining on identification devices or components will not be acceptable. Protect identification device units from damage until acceptance by Owner.

B. Remove packing and debris from the project site upon completion and leave the site in a condition which is clean and free of damage and abuse.

END OF SECTION

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SECTION 10 14 23
SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Room identification signs.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 10 14 03 - Identification Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Americans with Disabilities Act (ADA):
   a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
2. ASTM International (ASTM):
   a. B26, Standard Specification for Aluminum-Alloy Sand Castings.

1.3 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Building official, fire chief, fire marshal or other individual having statutory authority.

B. Wet and/or Corrosive Areas: For the purposes of this Specification Section, the following rooms or areas are considered wet and/or corrosive:

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Color charts for Engineer's color selection.
      1) Color selection shall be made from manufacturer's complete color line including all premium and special colors.
2. Schedule of all signs indicating text and graphics.
3. Layout drawings of all signage showing size, letter style, text, border, finish, and installation detail.
   a. Provide drawings for:
      1) Room identification signs.

B. Samples:

1. Room identification signs.
2. Fire and/or smoke barrier identification signs.
3. Aluminum letters.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Room identification signs:

a. ASE - Architectural Signs and Engraving.
b. ASI Signage Innovations.
c. Best Sign Systems.
d. Mohawk Sign Systems.
e. Nelson-Harkins.
f. Southwell Co.
g. Stamprite Supersine Identification Specialists.

2. Fire and/or smoke barrier identification signs:
   a. Brady.
   b. Panduit.
   c. Seton.
   d. Carlton Industries.

2.2 MATERIALS

A. Room Identification Signs:

1. Interior:
   a. Dry, non-corrosive areas: Melamine plastic suitable for raised lettering and Braille.
   b. .

2.3 FABRICATION

A. Room Identification Signs:

1. General:
   a. Raised text, border and graphics.
      1) Minimum 1/32 inches height.
      2) Provide international graphic symbology for all toilet, locker and shower rooms or combinations thereof, and for unisex toilet rooms and stairs.
      3) Provide handicap symbol on all signs for rooms meeting handicap requirements.
   b. Grade 2 Braille.
   c. Finish: Eggshell.
      1) Color: To be selected.
   d. Text:
      1) Typeface: Sans Serif.
      2) Size: Minimum 3/4 inches high.
   e. Text as indicated in the SCHEDULES Article in PART 3 of this Specification Section.
   f. Exterior signs shall be rated for exterior use.
   g. All signs shall comply with requirements of ADA state or local authority.
2. Typeface: Helvetica Medium.
3. Text Size:
   a. Height: 3 inches minimum.
   b. Stroke: 3/8 inches minimum.
   c. Text: As indicated in the SCHEDULES Article in PART 3Fabrication:

2.4 MAINTENANCE MATERIALS

A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Room Identification Signs:

1. Install signs using foam tape for interior signs
   a.
2. Mounting Locations:
   a. Tactile characters on signs shall be located 48 inches minimum above the finished floor or ground surface, measured from the baseline of the lowest tactile character and 60 inches maximum above the finish floor or ground surface, measured from the baseline of the highest tactile character.
   b. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leafs, the sign shall be located to the right side of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall.
   c. Signs containing tactile characters shall be located so that a clear floor space of 18 inches minimum by 18 inches minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position.
3. Interior and exterior signs identifying permanent rooms and spaces shall comply with ADA state or local authority.

3.2 SCHEDULES

A. Room Identification Signs:

BUILDING LOCATION	MOUNTING	VERBIAGE	REMARKS
BUILDING 10 – SCALE HOUSE			
DOOR 104	INTERIOR	UNISEX RESTROOM	1, 2
DOOR 105	INTERIOR	UNISEX RESTROOM	1, 2

BUILDING LOCATION	MOUNTING	VERBIAGE	REMARKS

REMARKS:

1. Provide Universal Graphic Symbology.
2. Mount adjacent to pull side of door.
3. Mount adjacent to push side of door.

END OF SECTION

SECTION 10 28 13
TOILET ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Toilet and Bath Accessories in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM A240/A240M Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip

B. U.S. Department of Justice:

1. ADA Standards for Accessible Design.

1.3 SUBMITTALS

A. Product Data:

1. Manufacturer's standard literature indicating systems and products specified.

B. Contract Closeout Information:

1. Maintenance data.
   a. See Section 01 78 23.
2. Letter stating that extra material has been delivered.

1.4 QUALITY ASSURANCE

A. Provide accessories from one manufacturer as far as practicable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Toilet and Bath Accessories:

1. Base:
   a. American Specialties, Inc. (ASI)
   b. As noted for specific items.
2. Optional:
   a. Bobrick Washroom Equipment
   b. Bradley
   c. GAMCO, a Division of Bobrick
   d. Seachrome
   e. Tubular Specialties Manufacturing (TSM)
   f. A & J Washroom Accessories
   g. Brey-Krause Manufacturing

B. Other manufacturers of a complete line of stainless steel accessories desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Type 304, 18-8 stainless steel per ASTM A240/A240M, unless noted otherwise.

1. Finish: Satin #4 on exposed surfaces.

B. Corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories.

C. See drawings for items, quantities, locations, and required mounting heights.

D. Locks:

1. Tumbler locks keyed alike.

2.3 TOILET ACCESSORIES

A. Toilet Tissue Dispensers:

1. TA-02:
   a. Double Roll Tissue Dispenser.
   b. Cast aluminum with ABS thermoplastic spindle.
   c. Model 0264-1A by ASI.
   d. Non-controlled delivery.

B. Sanitary Disposal:

1. TA-05:
   a. Model 0852 by ASI.
   b. Surface mounted.

C. Paper Towel Dispensers:

1. TA-06:
   a. Model 0210 by ASI
   b. Surface mounted.
   c. Capacity: 400 C-fold or 525 multi-fold towels

D. Waste Receptacles:

1. TA07:
   a. Model 0828 by ASI.
   b. Surface mounted.
   c. Mount with top at 36 inches AFF.

E. Soap Dispensers:

1. TA9V:
   a. Model 0347 by ASI.
   b. All-purpose valve.
   c. Surface mounted.
   d. Locate right side of mirror.
   e. Center over sink on side wall.
   f. Mount with spout at 42 inches AFF.

F. Mirrors:

1. TA-13:
   a. Model 0600 by ASI.
   b. Polished stainless steel framed mirror.
   c. 18 inches wide by 36 inches high.
2. TA24:
   a. Model 9020 by ASI.
   b. Child protection seat.
   c. Material:

1) High Density Polyethylene (HDPE).

G.

H. Grab Bars:

1. General:
   a. Base Products: 3800 Series by American Specialties.
   b. Bar Diameter: 1-1/2-inch OD.
   c. Concealed mounting.
   d. Include anchoring devices to withstand minimum concentrated load of 250 pounds typical and 800 pounds at bariatric locations.
   e. Include 3800M spacer to keep grab bar parallel to wall faces at offset conditions.
2. TA18:
   a. 18-inch horizontal grab bar.
3. TA36:
   a. 36-inch horizontal grab bar.
4. TA38:
   a. 48-inch horizontal grab bar.

I. Shelf with Towel Hooks:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrate to accept installation.

B. Coordinate and direct installation of backing where required for toilet accessories.

C. Verify that adequate wall backing has been installed.

1. Coordinate and direct installation backing where required for toilet accessories.
2. Utilize proprietary backing devices where available.
3. At remaining locations, provide metal backing per Section 09 22 16.

D. Correct deficiencies before proceeding to install accessories.

E. Where item is mounted on or in a toilet partition, coordinate interior reinforcing location with partition manufacturer.

F. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.

1. Install plumb, level, and rigidly anchored to substrates.

B. Where drawings or schedule require barrier-free accessibility, install accessories in accordance with applicable regulations.

C. Coordinate accessory locations to fit spaces.

D. Coordinate items to avoid mounting conflicts.

E. Mount items with theft-resistant fasteners.

F. Seal grab bar mounting plate to shower walls with silicone sealant or gasket prior to installation of bar.

3.3 ADJUSTING AND CLEANING

A. Protect accessories from damage due to construction.

1. Remove protective coverings when no longer required.

B. Test accessories and adjust for proper operation.

C. Clean exposed surfaces.

END OF SECTION

SECTION 10 41 00
EMERGENCY ACCESS CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Emergency Key Cabinets.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. Society of Automotive Engineers (SAE).
3. Underwriters Laboratories Inc. (UL):
   a. 1037, Standard for Antitheft Alarms and Devices.
4. Fire code:
   a. International Code Council (ICC):
      1) International Fire Code and associated standards, 2021 Edition including all amendments, referred to herein as Fire Code.

B. Qualifications:

1. Manufacturer shall be acceptable to the local Authority Having Jurisdiction (AHJ).

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.

1.4 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Building official, fire chief, fire marshal or other individual having statutory authority.

B. Galvanize, Galvanized or Galvanizing:

1. Sheet metal: Hot-dip zinc coated in accordance with ASTM A653/A653M, G60 minimum.
2. Steel fabrications and hardware: Hot-dip zinc coated in accordance with ASTM A153/A153M with minimum coating of 2.0 oz of zinc per square foot of metal (average of specimens) unless noted otherwise or dictated by standard.

1.5 SEQUENCING AND SCHEDULING

A. Delivered products to be incorporated into the Work in a timely manner for coordination with related trades.

1. Coordinate installation of conduit and wiring necessary for integration of tamper detection switches with controls system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Emergency Key Cabinets:
    a. Knox Company.
2. Locks:
    a. Medeco by ASSA ABLOY.

2.2 MANUFACTURED UNITS

A. Emergency Key Cabinets:

1. Knox 3200 Series.
2. Listed: UL 1037.
3. Recessed mounting.
4. High-security key box:
    a. Fully welded steel case.
    b. Minimum 1/4 inches thick steel.
    c. Size: Nominal 5 inches wide x 4 inches high x 3 inches deep.
    d. Integral flange.
5. Hinged door:
    a. Steel, 1/2 inches thick.
    b. Weather resistant door gasket.
    c. Stainless steel hinge.
6. Lock:
    a. UL listed.
    b. Double-action rotating tumblers.
    c. Hardened steel pins.
    d. Biased cut key.
    e. Hinged lock cover: Stainless steel, 1/8 inches thick.
7. Finish:
    a. Manufacturer’s proprietary finishing process.
    b. Corrosion resistant aluminized substrate.
    c. Color: Black.

2.3 ACCESSORIES

A. Recessed mounting shell and hardware for installation in wall construction.

1. Galvanized steel.
2. Size: 6 inches wide x 6 inches high x 4 inches deep.

B. Mounting Hardware:

1. Bolts:
    a. SAE Grade 5 or 8.
    b. Carriage head.
    c. Zinc chromate plated or galvanized.
    d. Emergency Information Cabinets: 5/16 inches diameter by length required.
    e. Emergency Key Cabinets: 3/8 inches diameter by length required.
2. Nuts and washers:

a. Match bolts.
b. Provide fender washer under bolt head and nut.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Prior to installation; verify locations and mounting heights shown on drawings with the AHJ.
   a. AHJ direction takes precedence over Drawings.
2. Install units in accordance with manufacturer's instructions and Fire Code.

B. Emergency Information Cabinets: Surface-mount with through-bolted connection as recommended by manufacturer.

C. Emergency Key Cabinets:

1. Install recessed mounting shell in conjunction with pre-engineered metal building.
2. Install key cabinet in mounting shell.
   a. Set flange in bead of sealant.
      1) Seal top and side flanges only.
      2) See Specification Section 07 92 00.
   b. Through-bolt as recommended by manufacturer.

END OF SECTION

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SECTION 10 44 33
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Portable fire extinguishers.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 05 50 00 - Metal Fabrications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Americans with Disabilities Act (ADA):
   a. 2010 ADA Standards for Accessible Design.
2. National Fire Protection Association (NFPA):
   a. 10, Standard for Portable Fire Extinguishers.
3. Underwriters Laboratories, Inc. (UL):
   a. 8, Water Based Agent Fire Extinguishers.
   b. 154, Carbon Dioxide Fire Extinguishers.
   c. 299, Dry Chemical Fire Extinguishers.
   d. 626, Water Fire Extinguishers.
   e. 711, Rating and Fire Testing of Fire Extinguishers.
   f. 2129, Halocarbon Clean Agent Fire Extinguishers.

1.3 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Building official, fire chief, fire marshal or other individual having statutory authority.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Ratings and classification of extinguishers.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver and install filled and charged extinguishers just prior to building occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Fire extinguishers:
   a. Amerex Corporation.
   b. Ansul – Tyco Fire Protection Products.
   c. Badger Fire Protection.

d. United Technologies - Kidde.
e. Buckeye Fire Equipment.

2. Fire extinguisher signs:
   a. Seton.
   b. Compliance Signs.
   c. Safety Sign.

2.2 MANUFACTURED UNITS

A. Fire Extinguisher (FEXT):

1. Steel bodied, all metal top (head) and valves.
2. Multi-purpose dry chemical extinguisher with hose and nozzle.
3. Provide one listed 10 pound. 4A-60BC extinguisher for each fire extinguisher location (FEXT) indicated on Drawings.
4. Finish: Red with epoxy finish coat.

B. Wall Brackets:

1. Bracket type to fit specified extinguisher.
2. Furnish bracket for each extinguisher not in cabinet.
3. Bracket to be finished in red or black enamel.

C. Fire Extinguisher Signage:

1. Single faced: SETON #21999.
2. Double faced: SETON #22001.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions and NFPA 10.

1. Install units with extinguisher top not over 48 inches above floor.
2. Install wall brackets to concrete or masonry substrate with self-tapping concrete anchors.
   a. See Specification Section 03 15 19.

B. Fire extinguisher locations shown on Drawings are approximate locations.

1. Verify all extinguisher mounting locations with the AHJ.

C. Provide "FIRE EXTINGUISHER" sign for each extinguisher location.

1. Provide single or double faced sign to provide optimum visibility for extinguisher location.

END OF SECTION

SECTION 10 51 13
METAL LOCKERS AND LOCKER BENCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal lockers .

B. Related Sections include but are not necessarily limited to:

1. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. A540/A540M, Standard Specification for Alloy-Steel Bolting Materials for Special Applications.
   b. A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.
   c. B108/B108M, Standard Specification for Aluminum-Alloy Permanent Mold Castings.

1.3 SUBMITTALS

A. Shop Drawings:

1. Drawings showing location, numbering sequence, anchoring method and locking.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Color chart showing manufacturer's full line of available colors for preliminary color selection by Engineer.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. See Specification Section 01 77 01 for closeout requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Lockers and locker benches:
   a. Art Metal Products.
   b. DeBourgh Manufacturing.
   c. List Industries, Inc.
   d. Lyon LLC.
   e. Penco Products.
   f. Republic Steel.

2.2 MATERIALS

A. Steel: ASTM A1008/A1008M.

B. Fasteners: Zinc-Nickel plated steel ASTM A540/A540M.

C. Hooks and Hanger Rods: Zinc-Nickel plated steel ASTM A540/A540M or cast aluminum ASTM B108/B108M.

2.3 ACCESSORIES

A. Hooks:

1. Provide one double-prong ceiling hook and three single-prong wall hooks for single-tier lockers.

B. Provide hat shelf in single-tier lockers.

1. Provide surface mounted USB charging station under electrical contract.

C. Provide hanger rod minimum 5/8 inches diameter, in lieu of ceiling hook, in single tier lockers 18 inches deep or deeper.

D. Number Plates:

1. Manufacturer's standard etched, embossed, or stamped, non-ferrous metal number plates.
2. Three-digit numerals not less than 3/8 inches high.
3. Sequence numbers as directed by Owner.
4. Attach plates centered, near top of each locker door, with two fasteners of same finish as number plate.
5. Provide on each locker door.

E. Metal Base:

1. Minimum 20 GA.
2. Cover entire front of base of lockers without additional fastening devices.
3. Flange bottoms inward 3/4 inches for stiffening.
4. Factory-finish base to match lockers.

2.4 FABRICATION

A. General:

1. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion.
2. Ease all exposed metal edges.
3. Weld frames together.
4. Weld, bolt, or rivet other connections per manufacturer's standard.
5. Grind exposed welds flush.
6. Chemically pretreat metal with degreasing and phosphatizing process.
7. Apply baked-on enamel finish to all surfaces, exposed and concealed, except plated and non-ferrous metal.
8. Finished film thickness of not less than 0.75 mil for all exterior surfaces and not less than 0.5 mil for all interior surfaces.

B. Lockers:

1. Frames:
   a. Minimum 16 GA channels or 12 GA angles, with corners electrically welded to form solid one-piece structure.
   b. Provide door stops at door openings.
   c. Provide minimum 16 GA horizontal members between doors of other than single-tier lockers.
2. Backs and sides:
   a. Minimum 24 GA.

b. Flange backs on vertical edges and sides where they intermember with backs, making double-flanged rear corners.

3. Exposed ends of non-recessed lockers: Minimum 16 GA.
4. Tops, bottoms, and shelves: Minimum 24 GA, flanged on all sides.
5. Sloped tops: Continuous, minimum 20 GA.
6. Doors:
   a. One-piece, minimum 16 GA, flanged at all edges, with corners.
   b. Extra bracing or reinforcing on inside of doors over 15 inches wide.
   c. Construct to prevent springing when opening or closing.
   d. Door swing of 180 degrees.
   e. Stamped louvered vents in door faces.
      1) Single-tier lockers: Not less than six 6 inches louver openings in top and bottom of each door.
7. Door hinges:
   a. Full-loop, five-knuckle, tight pin.
   b. Not less than 0.050 inches thick steel, 2 inches high.
   c. Continuous weld hinges to inside of frame and secure to door with not less than two factory-installed fasteners, completely concealed and tamperproof when door is closed.
   d. Minimum three hinges for each door 42 inches high and over.
   e.
8. Latching:
   a. Positive, automatic, pre-locking, pry-resistant latch and pull.
   b. Rubber silencers.
   c. Chromium-plated, vandalproof or kickproof lift-up handle, containing strike and hole for padlock.
   d. Enclose latch on four sides in a boxed receptacle in lock bar channel, and engaging latch hooks on frame opposite hinges.
   e. Three-point latching for single-tier lockers.
   f. One-point gravity or spring latch with padlock lugs for box lockers.
9. Provision for padlock: Latch pull with hole to accept padlock.
10. ADA compliant lockers:
    a. Single tier locker in same construction as standard lockers specified and provide with the following modifications:
       1) Shelves:
          a) Bottom shelf located not less than 9 inches above finished floor.
             (1) Provide full width closure panel from bottom shelf to locker floor.
          b) Top shelf located not more than 54 inches above finished floor.
       2) Top of hanger rod located not more than 48 inches above finished floor.
       3) Single-prong wall hooks located not more than 46 inches above finished floor.
       4) Door latching device:
          a) Lever handle, push type or U-shaped design.
          b) Operating device to be located 48 inches above finished floor.
          c) Spring loaded.
       5) Keyed lock to be self-locking when door is closed.
    b. Top of locker to align with adjacent lockers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install plumb, level, rigid and flush.

C. Space fasteners not over 48 inches on center:

1. Install through suitable reinforcing plates where necessary to prevent metal distortion.
2. Conceal all fasteners wherever possible.

D. Provide and install filler and closure pieces as required.

3.2 FIELD QUALITY CONTROL

A. Touch-up any damaged finishes or replace as directed by Engineer.

1. Use only materials and finishes as recommended or furnished by locker manufacturer.

3.3 ADJUSTMENT

A. Adjust doors and latches to operate easily without bind.

1. Verify satisfactory operation of integral locking devices.

3.4 SCHEDULES

A. Locker Types and Sizes:

1. Type A: Single tier 24 x 18 x 72 inches.

END OF SECTION

DIVISION 12

FURNISHINGS

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SECTION 12 24 13
ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Roller Shades, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. ASTM International (ASTM):

1. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
2. No growth for fungi ATCC9642, ATCC 9644, ATCC9645.

B. National Fire Protection Association (NFPA):

1. NFPA 70 National Electrical Code.
2. NFPA 701-2015, Standard methods for Fire Tests for Flame Propagation of Textiles and Films.
   a. Passes flame propagation performance criteria for Test Method.
3. NFPA Article 100 Electrical components listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system.

1.3 SUBMITTALS

A. Shop Drawings:

1. Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

B. Product Data:

1. Manufacturer's data sheets on each product to be used, including:
   a. Preparation instructions and recommendations.
   b. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
   c. Storage and handling requirements and recommendations.
   d. Mounting details and installation methods.
   e. Window treatment schedule:
      1) Use same room designations as indicated on Drawings and include opening sizes and key to typical mounting details.

C. Samples:

1. Provide for each finish product specified,
   a. One set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
   b. One set of shade components, unassembled, demonstrating compliance with specified requirements.
      1) Shadecloth sample and aluminum finish sample as selected.
      2) Mark face of material to indicate interior faces.

D. Contract Closeout Information:

1. Warranty.
2. Maintenance Data:
    a. See Section 01 78 39.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Obtain roller shades through one source from a single manufacturer.
2. Minimum 20 years of experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications:

1. Installer trained and certified by manufacturer with a minimum of 10 years of experience installing products comparable to those specified in this section.

C. Mock-up:

1. Provide a mock-up, for manual shades only, of one roller shade assembly for evaluation of mounting, appearance and accessories.
2. Locate mock-up at opening designated by Architect.
3. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.5 WARRANTY

A. Roller Shade Hardware: Manufacturer's standard non-depreciating 25 year limited warranty.

B. Shadecloth: Manufacturer's standard non-depreciating 10 year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Roller Shades:

1. Base:
    a. MechoShade Systems.
2. Optional:
    a. Draper.
    b. Hunter Douglas Contract.
    c. Lutron by Vimco.

B. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Transparent Single-Fabric Shadecloth:

1. Ecoveil 1750 by MechoShade Systems, Inc.
2. Single thickness 0.0358 inches TPO fabric.
3. NFPA 701 fire classifiction
4. Basket Weave: 1 percent open.
5. Color: as selected from manufacturer’s standard colors.

2.3 COMPONENTS

A. Manual Operated Chain Drive Hardware and Brackets:

1. Adjustable universal, regular and offset drive capacity.
2. Removable fascia with concealed fasteners.

3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide multiple shade operation by a single chain operator.
5. Minimum 1/8 inches thick plated steel.
6. Drive Bracket and Brake Assembly:
7. Model M5:
8. SnapLoc fascia, room darkening side / sill channels, center supports and connectors for multi-banded shades.
9. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 inches steel pin.

B. Drive Chain:

1. No.10 stainless steel chain
2. Rating: 90 pounds, minimum.

2.4 ACCESSORIES

A. Fascia for Shade Type RS-1:

1. Continuous extruded aluminum.
2. Conceal brackets, shade roller and fabric.
3. Provide bracket / fascia end caps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Allow clearances for window operation hardware.

B. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

C. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

D. Train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SCHEDULE

A. Shade Type 1:

1. Manual operating, chain drive.
2. Provide at exterior windows of rooms and spaces shown on Drawings.

END OF SECTION

SECTION 12 36 63
SOLID SURFACE FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Solid Surface Fabrications, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Applicable standards:

1. International Association of Plumbing and Mechanical Officials (IAPMO)
    a. IAPMO Z124 Plastic Plumbing Fixtures.
2. ASTM International:
3. National Electrical Manufacturers Association (NEMA).
    a. NSF International.
        1) NSF/ANSI Standard 51 for food zone - all food types.
4. Manufacturer’s certification of fabricator and installer.

B. Installer Qualifications:

1. Successfully installed at least five projects within the past four years, utilizing systems, materials and techniques as specified or required by product manufacturer.

C. Manufacturer Certification of Fabricator and Installer:

1. Certified by manufacturer.
2. Submit prior to Shop Drawings.

1.3 SUBMITTALS

A. Shop Drawings:

1. Show location of each item, dimensioned plans and elevations, large scale details, attachment devices and other components.
2. Show full size details, edge details, thermoforming requirements, attachments, etc.
3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

B. Product Data:

1. Manufacturer’s product data sheets, details and installation instructions for Solid Surface Fabrications, components, and accessories.

C. Samples:

1. For each SSF color selected:
    a. Minimum 6 inches x 6 inches sample in specified gloss.
    b. Cut sample and seam together for representation of inconspicuous seam.
    c. Indicate full range of color and pattern variation.
2. Sealant colors for selection.

3. Approved samples will be retained as a standard for work.

D. Project Information:

1. Manufacturer's current certification of Fabricator and Installer prior to submittal of Shop Drawings.

E. Contract Closeout Information:

1. Warranty.
2. Maintenance data.
   a. See Section 01 77 01.

1.4 WARRANTY

A. Manufacturer's ten (10) year warranty including colorfastness and material defects.

1. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Solid Surface Fabrications (SSF):

1. Base:
   a. Formica.
2. Optional:
   a. Corian by DuPont.
   b. Avonite by Aristech Acrylics LLC.
   c. Hi-Macs by LG Decorative Surfaces.
   d. Wilsonart Solid Surface.

B. Sealant:

1. Base:
   a. Color Rite.
2. Optional:
   a. As approved by SSF manufacturer.

C. Other manufacturers desiring approval comply with Section 01 61 00.

2.2 MATERIALS

A. Solid Surface Materials:

1. Cast, non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments.
   a. Prime product may not be coated, laminated or of composite construction.
2. Defects with depth less than 0.010 inches shall be considered superficial.
   a. Repair superficial damage by sanding and/or polishing.
   b. Components with more severe defects shall be rejected.
3. Physical properties:

Minimum Physical Properties		
Property	Method	Value
Tensile Strength	ASTM D638	5500 psi
Flexural Strength	ASTM D790	10 ksi
Hardness	Rockwell M Scale ASTM D785	Greater than 85

	Barcol Impressor ASTM D2583	55
Thermal Expansion	ASTM D696	1.8 x 10-5 inches/IN/deg F
Gloss (60 –degree Gardner)	IAPMO Z124	Matte = 5; Highly Polished = 75
Light Resistance	NEMA LD 3-2000 Method 3.3	No Effect (Xenon Arc)
Wear and Cleanability	IAPMO Z124	Pass
Stain Resistance	IAPMO Z124	Pass
Fungal Resistance	ASTM G21	Does not support growth
High Temperature Resistance	NEMA LD 3-2000 Method 3.6	No change
Boiling Water Resistance	NEMA LD 3-2000 Method 3.5	No visible change
Ball Impact Resistance; 1/2 pounds Ball	NEMA LD 3-2000 Method 3.5	36 inches drop 1/4 inches sheet
		144 inches drop 1/2 inches sheet
Water Absorption	ASTM D570	0.8% for 1/4 inches sheet
		0.6% for 1/2 inches sheet
Flammability	ASTM E84 and NFPA 255	Class I / Class A
Flame Spread Index		Less than 25
Smoked Developed Index		Less than 450

B. Backing materials (build down):
   1. Finished or exposed edges: SSF material.
      a. Profiles as indicated.
   2. Concealed spaces and non-exposed edges:
      a. Moisture resistant, medium density fiberboard (MDF) panels or moisture resistant plywood.
         1) Use at countertops with sinks
         2) No added formaldehyde (NAF)
         3) Particleboard is not acceptable.
         4) Base Product: Medex by Roseburg.
      b. Physical Properties, Based on 3/4 inches Thickness, ASTM D1037, Part A:
         1) Density: 48 pounds/FT3.
         2) Modulus of Rupture: 4,000 psi.
         3) Screw Holding: Required to pull 1 inch #10 sheet metal screw:
            a) Face: 225 pounds.
            b) Edge: 200 pounds.
      c. Panel Thickness:
         1) As required for application, use a single thickness to achieve build down to cross sectional thickness.
   3. Backer Sheets for knee spaces:
      a. Plastic laminate in coordinating color
      b. Grade 20 (VGP)
      c. Apply to bottom side of backing material
   4. Backing materials adhesive:
      a. Construction grade adhesive recommended by SSF manufacturer for backing materials with VOC content no greater than 70 g/L.

C. Joint Adhesive:
   1. Manufacturer's standard one- or two-part adhesive as required for inconspicuous, non-porous joint with VOC content no greater than 80 g/L.

D. Sealant:

1. Mildew resistant silicone sealant in colors matching components.
2. Specifically formulated for applications indicated, including wet areas.
3. Shore A Hardness: 25.
4. Compatible with SSF specified.
5. Compatible with gypsum wallboard, paint, laminates, and other materials being sealed.
6. Sealant VOC content shall be no greater than 250g/L.
7. Colors:
    a. Colors to match specified SSF colors from no less than 400 standard color choices.
    b. Number of different colors required for project shall not be limited.
8. Base Products:
    a. At solid colored SSF: Color-Sil by Color Rite; 100% silicone.
    b. Where speckle colored SSF is specified: Poly-Sil by Color Rite; 100% silicone with suspended accent color particles.
    c. Architect to select final colors and locations during submittals phase.

E. Conductive Foil Tape:

1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

F. Insulating Felt Tape:

1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.3 SHOP FABRICATION

A. Shop Assembly

1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's instructions.
2. Form joints between components using color matched Joint Adhesive in an inconspicuous manner.
    a. Reinforce with 4 inches wide strip of SSF material.
3. Provide factory cutouts for plumbing fittings and bath accessories as indicated.
    a. Radius inside corners of cutouts as large as but not less than 1/4 inches.
    b. Reinforce with SSF corner blocks to avoid stress cracking.
    c. Sand edges and corners smooth and free of chips or nicks.
    d. Utilize heat conductive aluminum tape around drop-in stoves and other heat sources to protect SSF from thermal stress.
4. Rout and finish component edges with clean, sharp returns.
    a. Rout cutouts, radii, and contours to template.
    b. Smooth edges.
    c. Repair or reject defective and inaccurate work.
5. Fabricate coved splashes where indicated.
6. Reinforce inside corners, narrow pieces, cantilevered overhangs, and stress points against breakage by laminating an additional thickness of SSF on concealed face.
7. Laminate additional thicknesses of SSF and tool edge profiles indicated.
8. Uniformly finish completed pieces according to SSF schedule.

2.4 FABRICATIONS

A. SSF Window Sills:

1. Configurations detailed on Architectural Drawings.
2. Thickness: Minimum 1/2 inches (unless otherwise indicated).
3. Join multiple pieces with joint adhesive to create inconspicuous seam.
4. Edge Treatments: As indicated on the drawings.
5. Polish exposed faces.
6. SSF Color / Pattern / Finish: Per SSF Schedule.

B. SSF Wall Caps, Niches and Similar Decorative Uses:

1. Configurations detailed on Architectural Drawings.
2. Thickness: Minimum 1/2 inches, unless otherwise indicated.
3. Join multiple pieces with joint adhesive to create inconspicuous seam.
4. Edge treatments: As indicated on the drawings.
5. Polish exposed faces.
6. SSF color / pattern / finish: Per SSF Schedule.

C. SSF Countertops:

1. Configurations as indicated on the IC-series Drawings.
2. Composite thickness of countertop assemblies: 1-1/4 inches unless otherwise indicated.
    a. Nominal Thickness of SSF material: Minimum 1/2 inches unless otherwise indicated.
3. Radius exposed outside corners: Minimum 1-1/2 inches.
4. Join multiple pieces, where required, with Joint Adhesive to create inconspicuous seam.
5. Backer:
    a. Configure backing material as required for application:
    b. Ladder frame at SSF countertops supported by base cabinets:
        1) Form ladders from approved backing material ripped into 3- 4 inches wide strips.
        2) Locate main runner strips (rails) along front and back edges of countertops.
            a) Provide clearance for shrinkage and normal expansion and contraction.
        3) Space front-to-back supports (stiles) to align with line where base cabinet units adjoin. Locate stiles over other wall brackets and supports.
        4) Where base cabinets and supports exceed in 24 inches width: Include additional intermediate stiles so that maximum spacing does not exceed 24 inches.
        5) Provide additional intermediate stiles at seams in SSF countertop material.
        6) Join the stiles to rails using screwed or glued wooden biscuit seams, serrated dowels, or rabbeted seams.
        7) Overhangs: Configure backer material per SSF manufacturer's guidelines according to distance overhang projects past its support.
    c. Countertops which span between supports 30 inches and wider:
        1) Fabricate backer from solid backing material (not stile and rail construction).
        2) Extend one piece, solid backer material, across entire span. Extend load bearing edges not less than 4 inches over edge of supporting cabinets (or similar support).
    d. Portions of Countertops schedule to support countertop equipment:
        1) Provide full backing for the entire countertop cross section for the full width of the equipment.
        2) Extend 4 inches (min) beyond equipment width and as required for mounting.
6. Backsplashes and Sidesplashes:
    a. Provide where indicated.
    b. Thickness: Minimum 1/2 inches (unless otherwise indicated).
    c. Height: As indicated.

d. Fabricate from same material and color as top.
e. Backsplash Style: Integrally coved.
f. Sidesplash Style: Applied.

7. Front overhang of Tops: 1-1/2 inches, unless otherwise indicated.
8. Edge Treatments: As indicated on the drawings.
9. Polish exposed faces.
10. SSF color / pattern / finish: Per SSF Schedule.

D. Integral SSF Sinks:

1. Material: Cast, homogenous material composed of polyester and acrylic resins, fire retardant filler materials, and coloring agents.
2. Shapes complying with IAPMO Z124 standards for plastic sinks and lavatories.
3. Mounting: Seamed under mount.
4. Mounting hardware: Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.
5. Provide bowl size and depth as indicated on IC-series elevations.
6. Base Product: Model # 810.
7. Color: Cameo White.

E. Sinks specified elsewhere:

1. Porcelain, enameled steel and/or stainless steel bowls: Specified in Section 22 42 00.

F. Faucets and Trim: Specified in Section 22 20 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Verify measurements, dimensions and drawing details before proceeding.
2. Coordinate location of furring, nailers, blocking, grounds, and similar supports for attached work.
3. Examine conditions under which work is to be installed.
4. Correct unsatisfactory conditions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. General:

1. Install components plumb, level, and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
2. Provide product in the largest pieces available.
3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
   a. Exposed joints/seams will not be allowed.
4. Reinforce field joints with SSF strips extending a minimum of 1 to 2 inches on either side of the seam with the strip being the same thickness as the top.
5. Cut and finish component edges with clean, sharp returns.
6. Rout radii and contours to template.
7. Anchor securely to base cabinets or other supports.

8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
10. Install countertops with no more than 1/8 inches sag, bow or other variation from a straight line.
11. Units with sinks or lavatories shall withstand an applied vertical load of not less than 250 pounds on front edge of countertop.

B. Window Stools (sills):

1. Shim as required so that installed items are plumb, true, and level.
2. Install Window Sills full length of window, set securely into place using only concealed fasteners and approved adhesive.
3. Adhere sills to substrate with dabs of a clear silicone sealant at 10 to 12 inches intervals.
4. Where sills are abutted by walls at both ends: Allow 1/8 inches expansion gaps at both ends for every of 10 feet sill.
    a. Seal gaps with elastomeric sealant.
5. Ease edges and sand smooth.

C. Countertops:

1. Install plumb, level, true and straight.
    a. Shim as necessary using concealed shims.
2. Adhere tops to base cabinets with clear silicone sealant at 10 to 12 inches apart.
3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
    a. Supply additional wood supports, spaced no more than 18 inches apart or as otherwise required for adequate strength.
4. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
    a. Ensure full contact with support brackets and backing for entire support length with mechanical fastening into backing material.
    b. Provide fasteners of appropriate length. Do not allow screws to penetrate into SSF material.
    c. Supply additional supports or solid backing as required for adequate strength.
5. Where tops are abutted by walls at both ends:
    a. Include 1/8 inches expansion gaps at both ends for every of 10 feet countertop.
    b. Seal gaps with elastomeric sealant.

D. Backsplashes and Sidesplashes:

1. Integrally Coved Splashes:
    a. Join coved items to countertops using color matched Joint Adhesive.
    b. Adhere to walls and other substrates with clear silicone sealant.
    c. Seal to walls and adjacent cabinets with color matched, elastomeric sealant.
2. Applied Splashes:
    a. Join adhered items to substrate using color matched, elastomeric sealant.
    b. Adhere to walls and other substrates with clear silicone sealant.
    c. Seal to walls and adjacent cabinets with color matched, elastomeric sealant.

E. Integral SSF Sinks:

1. Install SSF sink or lavatory bowls in locations shown on the drawings.
2. Secure bowls to tops using Joint Adhesive and mounting hardware to maintain warranty.

3. Drain connections: Specified in Section 22 20 00.

F. Sinks:

1. Install sinks per Section 22 20 00.
2. Seal to Countertop with elastomeric sealant and mounting hardware provided.
3. Drain and overflow connections: Specified in Section 22 42 00.

G. Faucets and Trim:

1. Install faucets and trim per Section 22 20 00.
2. Plumbing connections: Specified in Section 22 20 00.
3. Seal to Countertop with elastomeric sealant.

3.3 CLEANING AND PROTECTION

A. Keep components clean during installation.

B. Protect finished surfaces from damage.

C. Remove adhesives, sealants, and other stains.

D. Replace damaged work which cannot be repaired.

END OF SECTION

DIVISION 22

PLUMBING

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SECTION 22 05 03

PIPE AND PIPE FITTINGS - PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing Piping.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 22 05 29 – Hanger and Support for Plumbing Piping and Equipment
2. Section 23 07 00 - Pipe, Duct and Equipment Insulation.
3. Section 22 05 23 - General Duty Valves for Plumbing Applications.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B1.2, Gages and Gaging for Unified Screw Threads.
   b. B31.1, Power Piping.
   c. B31.3, Process Piping.
   d. B31.9, Building Services Piping.
   e. B40.100, Pressure Gauges and Gauge Attachments.
2. ASTM International (ASTM):
   a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
   c. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   d. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   e. B32, Standard Specification for Solder Metal.
   f. B88, Standard Specification for Seamless Copper Water Tube.
   g. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
3. American National Standards Institute (ANSI/ASTM):
   a. B16.3, Malleable Iron Threaded Fittings.
   b. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
   c. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
   d. B16.23, Cast Copper Alloy Solder Joint Drainage Fittings (DWV).
   e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
4. American Water Works Association (AWWA):
   a. B300-10, Standard for Hypochlorites.
   b. C110, Standard for Ductile-Iron and Gray-Iron Fittings.
   c. C150, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   d. C151, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
   e. C203, Coal-Tar Protective Linings for Steel.
   f. C206, Field Welding of Steel Water Pipe.
   g. C207, Steel Pipe Flanges for Waterworks Service.

h. C606, Grooved and Shouldered Joints.
i. C651, Disinfecting Water Mains.
j. M11, Steel Pipe- A Guide for Design and Installation.

5. American Welding Society (AWS):
   a. A5.8M/A5.8, Specification for Filler Metals for Brazing and Braze Welding.
6. Chlorine Institute, Inc. (CI):
   a. Pamphlet 6, Piping Systems for Dry Chlorine.
7. Cast Iron Soil Pipe Institute (CISPI):
   a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.

B. Qualifications:

1. Use only certified welders meeting procedures and performance outlined in ASME Section IX, AWWA C200 Section 3.3.3 and other codes and requirements per local building and utility requirements.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
   c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
      1) Attach technical product data on gaskets, pipe, fittings, and other components.
2. Welders' certificates.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. See for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.

C. Informational Submittals:

1. Qualifications of lab performing disinfection analysis on water systems.
2. Test reports:
   a. Copies of pressure test results on all piping systems.
   b. Reports defining results of dielectric testing and corrective action taken.
   c. Disinfection test report.
   d. Notification of time and date of piping pressure tests.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Couplings:
   a. Dresser.
   b. Smith-Blair.
2. Mechanical Couplings:
   a. Victaulic.

b. Tyler.

3. Expansion Fittings:
   a. Flexicraft.
   b. Mason.
   c. Metraflex.

2.2 MATERIALS

A. Piping Systems:

1. Piping systems are scheduled by service in PART 3 of this specification.

B. Pipe and Tube:

1. Copper:
   a. Type K, L, or M tube per ASTM B88.
   b. Utilize only annealed (soft) type tubing where flared joints are used and drawn temper (hard) type tubing where soldered or brazed joints are used.
   c. Fittings, per System Type:
      1) Cast copper or bronze (pressure): Per ASTM B16.18.
      2) Wrought copper or bronze (pressure, solder): ASTM B16.22.
      3) Cast copper or bronze (DWV): Per ASTM B16.23.
      4) Wrought copper or bronze (pressure, flared): Per ASTM B16.26.
   d. Joints:
      1) Flared.
      2) Soldered or Brazed:
         a) Above ground below 180 degrees F: ASTM B32 solder with a tin/antimony ratio of 95/5 and non-corrosive flux.
         b) Above ground 180 degrees F and above: use brazing alloy with melting temperature above 1000 degrees F and suitable flux.
         c) Buried: Silver solder per AWS A5.8M/A5.8.
         d) Provide unions and valves and equipment.
   e. Unions: Class 150, bronze.
2. Steel:
   a. Schedule 10, 40 or 80 per ASTM A53.
   b. Finish: Black or hot-dip galvanized per ASTM A53.
   c. Fittings: Per System Type:
      1) Malleable iron: Per ASTM B16.3.
      2) Forged Steel: Per ASTM A234.
      3) Cast Iron: Per ASTM A126.
   d. Joints: Per System Type:
      1) Threaded.
         a) With unions and valves and equipment.
      2) Flanged with rubber gaskets.
      3) Socket or butt welded.
   e. Unions: Class 150, malleable iron, threaded.
3. Ductile Iron:
   a. Pressure class per system type per AWWA C150 or AWWA C151.
   b. Fittings: Ductile or gray iron per AWWA C110, standard thickness
   c. Joints, per System Type:
      1) Flanged with rubber gasket.

2) Grooved coupling per AWWA C606.

4. Cast Iron Soil Pipe
   a. Service weight, ASTM A74.
   b. Fittings, per System Type:
      1) Hubless per CISPI 310.
      2) Hub and spigot per ASTM A74.
   c. Joints, per System Type:
      1) Neoprene gaskets and stainless steel clamp and shield assemblies per CISPI 310.
      2) Rubber gasket joint devices per ASTM C564.
      3) Lead and oakum per ASTM C564.
   d. Coatings:
      1) Bituminous.

2.3 MANUFACTURED UNITS

A. Unions:

1. Copper pipe:
   a. Copper ground joint unions for pipe sizes 2 inches and smaller.
   b. Brass flanged unions for pipe sizes larger than 2 inches.

B. Couplings:

1. Ductile Iron pipe:
   a. Flanged:
      1) Steel sleeve flange and followers.
      2) Grade 30 rubber gasket.
      3) Flanges to meet standards of adjoining flanges.
   b. Compression sleeve:
      1) Steel sleeve and followers.
      2) Flanges to meet standards of adjoining flanges.
      3) Provide field coating for buried couplings per AWWA C203.
   c. Mechanical couplings:
      1) In accordance with AWWA C606.

2.4 ACCESSORIES

A. Heating Water Application:

1. For steel heating lines, provide braided, flanged stainless steel connectors for connection to equipment.
2. Provide pump connectors with stainless steel construction, rubber filled bellows and flanged end connections.

B. Natural Gas Equipment Isolator: 316L stainless steel, T-321 stainless steel braid with connections compatible with joints in piping system.

C. Bellows-type Expansion Fitting:

1. Single sphere style stainless steel construction.
2. Pressure rating: 125 psiG.
3. Temperature Rating: 250 degrees F.
4. Maximum Compression: 1-3/4 inches.
5. Maximum Extension: 1/4 inches.
6. Joint: As specified for individual piping system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends.

B. Remove burrs.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment with flanges and unions.

E. Deep open ends of pipe free from scale and dirt.

F. Protect open ends with temporary plugs or caps.

3.2 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise shown on the Drawings, provide a minimum of 4 feet and maximum of 8 feet earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals.

C. When entering or leaving structures with buried mechanical joint piping, install joint within 2 feet of point where pipe enters or leaves structure.

1. Install second joint not more than 6 feet or less than 4 feet from first joint.

D. Install expansion devices as necessary to allow expansion and contraction movement.

E. Lining Up Push-On Joint Piping:

1. Lay piping on route lines shown on Drawings.
2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
3. Observe maximum deflection values stated in manufacturer's written literature.
4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.
5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

F. Anchorage and Blocking:

1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
   a. Concrete blocks shall not cover pipe joints.
3. Provide bearing area of concrete in accordance with drawing detail.

G. Install underground hazard warning tape.

H. Install insulating components where dissimilar metals are joined together.

3.3 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 inches may not be shown; however, install according to Drawing intent and with clearance and allowance for:

1. Expansion and contraction.
2. Operation and access to equipment, doors, windows, hoists, moving equipment.
3. Headroom and walking space for working areas and aisles.
4. System drainage and air removal.

C. Enter and exit through structure walls, floor and ceilings using penetrations and.

D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

E. Pipe Support:

1. Use methods of piping support as shown on Drawings and as required in Specification Section 22 05 29.
2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
    a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
3. Size pipe supports with consideration to specific gravity of liquid being piped.

F. Locate and size sleeves and castings required for piping system.

1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

G. Use reducing fittings throughout piping systems.

1. Bushings will not be allowed unless specifically approved.

H. Equipment Drainage:

1. Provide drip pans and piping at equipment where condensation may occur.
2. Avoid piping over electrical components such as motor control centers, panelboards, etc.
    a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
    b. Hard pipe drainage to nearest floor drain.

I. Miscellaneous Piping:

1. If system is not otherwise specified, provide stainless steel tubing.
2. Size to handle application with 3/4 inches being minimum size provided.

J. Unions:

1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
2. Mechanical type couplings may serve as unions.
3. Additional flange unions are not required at flanged connections.

K. Install expansion devices as necessary to allow expansion/contraction movement.

L. Provide full face gaskets on all systems.

M. Anchorage and Blocking:

1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

N. Equipment Pipe Connections:

1. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.
2. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.
3. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.
    a. Provide wheel handle stop valve at each laboratory sink water supply.
    b. Minimum size: 1/2 inches.

4. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.
    a. Size trap as required by IPC.
5. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed.

O. Provide insulating components where dissimilar metals are joined together.

3.4 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.5 ACCESS PROVISIONS

A. Comply with the access doors or panels requirements as specified in section 08 31 00 - Access Doors.

3.6 CATHODIC PROTECTION

A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.

B. Make all connections from wire or cable by Thermit Cad welding accomplished by operators experienced in this process.

C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50% of the straight line length.

D. After cad welding, coat all exposed metallic surfaces with hot applied tape.

3.7 INSTALLATION – PIPE SYSTEM SPECIFIC

A. Potable Water Piping Installation:

1. Install drain tees with capped nipples of IPS brass 3 inches long at low points.
    a. If low point occurs in concealed piping, provide approved flush access panel.
    b. These drains are not shown on Drawings.
2. Slope water lines down to drain points not less than 1 inch in 60 feet.
3. Install all threaded piping with clean-cut tapered threads and with ends thoroughly reamed after cutting to remove burrs.
    a. Pipe joint cement permitted only on external threads.
4. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.
5. Install ball, butterfly and plug valves where indicated or required to adequately service all parts of system and equipment.

a. Install valves on each branch serving restroom.
b. Install valves on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.

6. Install unions between valves and connections to each piece of equipment, and install sufficient number of unions throughout piping system to facilitate installation and servicing.
   a. On copper pipe lines, install wrought, solder-joint, copper to copper unions for lines 2 IN and smaller and, for lines 2-1/2 inches and over install brass flange unions.
7. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely eliminate any danger of siphoning waste material into potable water supply system.
8. Where exposed pipes 6 inches in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to completely close hole around pipes.
   a. Secure plates to pipe by set screw in approved manner.
9. Size supply branches to individual fixtures as scheduled or indicated on Drawings.
10. Install piping so as to be free to expand with proper loops, anchors and joints without injury to system or structure.
11. Provide branches to wall hydrants or hose bibbs in exterior locations with interior shutoff and drain valves.
12. Provide approved type vacuum breaker and backflow preventer installations indicated or as required by Code.
13. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.

B. Soil and Waste Piping Installation:

1. Install horizontal soil or waste lines less than 4 inches diameter with a slope of not less than 1/4 IN/FT or 2% toward the point of disposal.
2. Install 4 inches and larger piping at 1/8 inches/FT.
3. Install as close to construction as possible to maintain maximum head room.
4. Make changes of direction with 1/8 bends and junctions with wye fittings.
5. Use short wye fittings in vertical pipe only.
6. Install handhole test tee at base of each stack.
7. Install cleanouts at dead ends, at changes of direction and at 50 feet intervals on horizontal runs.
   a. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to walls as required.
8. Install piping true to grade and alignment.
   a. Begin at the system low point.
9. Locate vertical extensions of underground piping below partition walls for concealment in wall.
   a. In locations where hubs are wider than partition, set hubs 1 inch below final floor.
10. Install concealed, in finished structures such as administration and office facilities and at locations shown on Drawings.
11. For hub and spigot joints, install hub facing flow.

C. Vent Piping Installation:

1. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures.
2. Originate each vent stack from soil or waste pipe at its base.
3. Where possible, combine soil, waste or vent stacks before passing through roof so as to minimize roof openings.
4. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing.

5. Provide pipes passing through roofs with cast iron increaser's minimum of 12 inches below roof one size larger than pipe but in no case less than 4 inches.
6. Terminate each vent with approved frost proof jacket.
7. Carry vent stacks 4 inches and larger full size through roof.
    a. Extend vent stacks at least 12 inches above roofing.
8. Pipe vents from pressure regulating devices in compliance with local codes.
9. Install concealed in finished structures such as administration and office facilities and at locations shown on Drawings.

3.8 JOINING

A. Install products in accordance with manufacturer's instructions.

B. Joining Methods - Flanges:

1. Facing method:
    a. Insert slip-on flange on pipe.
    b. Assure maximum tolerances for flange faces, from normal with respect to axis of pipe, is 0.005 inches per foot of flange diameter.
    c. Test flanges after welding to pipe for true to face condition and reface, if necessary, to bring to specified tolerance.
2. Joining method:
    a. Leave 1/8 to 3/8 inches of flange bolts projecting beyond face of nut after tightening.
    b. Coordinate dimensions and drillings of flanges with flanges for valves, pumps, equipment, tank, and other interconnecting piping systems.
    c. When bolting flange joints, exercise extreme care to assure that there is no restraint on opposite end of pipe or fitting which would prevent uniform gasket compression or cause unnecessary stress, bending or torsional strains being applied to cast flanges or flanged fittings.
        1) Allow one flange free movement in any direction while bolts are being tightened.
    d. Do not assemble adjoining flexible coupled, mechanical coupled or welded joints until flanged joints in piping system have been tightened.
    e. Gradually tighten flange bolts uniformly to permit even gasket compression.
    f. Do not overstress bolts to compensate for poor installation.

C. Joining Method - Welded Joints:

1. Perform welding in accordance with AWWA C206 and this Section.
2. For flange attachment perform in accordance with AWWA C207.
3. Have each welding operator affix an assigned symbol to all his welds.
    a. Mark each longitudinal joint at the extent of each operator's welding.
    b. Mark each circumferential joint, nozzle, or other weld into places 180 degrees apart.
4. Welding for all process piping shall conform to ASME B31.3.
    a. Welding of utility piping 125 psi and less shall be welded per ASME B31.9.
    b. Utility piping above 125 psi shall conform to ASME B31.1.
5. Provide caps, tees, elbows, reducers, etc., manufactured for welded applications.
6. Weldolets may be used for 5 inches and larger pipe provided all slag is removed from inside the pipe.
7. Weld-in nozzles may be used for branch connections to mains and where approved by Engineer.
8. Use all long radius welding elbows for expansion loops and bends.
9. Use long radius reducing welding elbows 90 degrees bends and size changes are required.

D. Joining Method - Couplings:

1. Compression sleeve:
    a. Install coupling to allow space of not less than 1/4 inches but not more than 1 inch.
    b. Provide harnessed joint.
        1) Use joint harness arrangements detailed in AWWA M11.
    c. Design harness assembly with adequate number of tie rods for test pressures indicated in Section 40 05 00 and allow for expansion of pipe.
    d. Provide ends to be joined or fitted with compression sleeve couplings of the plain end type.
    e. Grind smooth welds the length of one coupling on either side of joint to be fitted with any coupling.
    f. Assure that outside diameter and out-of-round tolerances are within limits required by coupling manufacturer.
2. Mechanical coupling:
    a. Arrange piping so that pipe ends are in full contact.
    b. Groove and shoulder ends of piping in accordance with manufacturer's recommendations.
    c. Provide coupling and grooving technique assuring a connection which passes pressure testing requirements.

E. Joining Method - Threaded and Coupled (T/C):

1. Provide T/C end conditions that meet ASME B1.2 requirements.
2. Furnish pipe with factory-made T/C ends.
3. Field cut additional threads full and clean with sharp dies.
4. Leave not more than three pipe threads exposed at each branch connection.
5. Ream ends of pipe after threading and before assembly to remove burrs.
6. Use Teflon thread tape on male thread in mating joints.

3.9 FIELD QUALITY CONTROL

A. Pipe Testing - General:

1. Test piping systems as follows:
    a. Test exposed, non-insulated piping systems upon completion of system.
    b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.
    c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.
    d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.
2. Isolate equipment which may be damaged by the specified pressure test conditions.
3. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.
    a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.
    b. Notify the Engineer 24 hours prior to each test.
4. Completely assemble and test new piping systems prior to connection to existing pipe systems.
5. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
6. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:

1. Testing medium:
   a. Water systems: Water.
   b. Waste and drain systems: Water.
2. Testing pressure:
   a. See below for gravity systems.
   b. For pumped systems, test at no less than 125% of pump head plus the system fill pressure.
   c. For pressurized systems, test at 150 psiG.
3. Allowable leakage rates:
   a. Natural gas systems, all exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage at the specified test pressure throughout the duration of the test.
   b. Non-hazardous gas and air systems which are tested with air shall have a maximum pressure drop of 5% of the specified test pressure throughout the duration of the test.
4. Hydrostatic pressure testing methodology:
   a. General:
      1) All joints, including welds, are to be left exposed for examination during the test.
      2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
      3) Provide temporary restraints for expansion joints for additional pressure load under test.
      4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
      5) Do not paint or insulate exposed piping until successful performance of pressure test.
   b. Soil, waste, drain and vent systems:
      1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
      2) Eliminate leaks before proceeding with work or concealing piping.
      3) Minimum test heights shall be 10 feet above highest stack inlet.

C. Dielectric Testing Methods and Criteria:

1. Provide electrical check between metallic non-ferrous pipe or appurtenances and ferrous elements of construction to assure discontinuity has been maintained.
2. Wherever electrical contact is demonstrated by such test, locate the point or points of continuity and correct the condition.

3.10 CLEANING, DISINFECTION AND PURGING

A. Cleaning:

1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
4. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.
5. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.

a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

B. Disinfection of Potable Water Systems:

1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. Perform disinfection using sodium hypochlorite complying with AWWA B300-10.
4. Flush each segment of system to provide flushing velocity of not less than 2.5 feet per second.
5. Drain flushing water to sanitary sewer.
   a. Do not drain flushing water to receiving stream.
6. Use continuous feed method of application.
   a. Tag system during disinfection procedure to prevent use.
7. After required contact period, flush system to remove traces of heavily chlorinated water.
8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
   a. Repeat entire disinfection procedures until satisfactory results are obtained.
9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
   a. Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of State of Iowa.

3.11 SCHEDULES

A. System 1 - Potable Water:

1. Piping symbol and service:
   a. CW – Potable Cold Water.
   b. HW – Potable Hot Water.
   c. An “R” designation after piping symbol denotes Recirculation.
2. Above ground, less than 3 inches diameter:
   a. Pipe: Type L Copper.
   b. Fittings: Wrought Copper or bronze.
   c. Joints: Brazed or Soldered.
3. Above ground, 3 inches diameter and larger:
   a. Pipe: Ductile Iron, Class 150.
   b. Fittings: Ductile or Gray Iron.
   c. Joints: Flanged or grooved mechanical couplings.
4. Buried, less than 3 inches diameter:
   a. Pipe: Type K Copper.
   b. Fittings: Cast or Wrought Copper.
   c. Joints: Flared.
5. Buried, 3 inches diameter and larger:
   a. Pipe: Ductile Iron, Class 150.
   b. Fittings: Ductile or Gray Iron.

c. Joints: Push-on mechanical stuffing box type at fittings and valves.

B. System 2 - Non Potable Water:

1. Piping symbol and service:
   a. NPW – Nonpotable Water.
2. Above Ground:
   a. Pipe: Schedule 40 Galvanized Steel.
   b. Fittings: Malleable Iron or Forged Steel.
      1) Galvanized.
   c. Joints: Threaded.

C. System 3 - Waste and Vent:

1. Piping symbol and service:
   a. WST – Waste.
   b. SAN – Sanitary Sewer.
   c. V – Vent.
   d. SW – Storm Water.
2. Above ground, less than 2 inches diameter:
   a. Pipe: Schedule 40 Galvanized Steel.
   b. Fittings: Cast Iron DWV.
   c. Joints: Threaded.
   d. Pipe: DWV grade PVC.
   e. Fittings: DWV PVC.
   f. Joints: Solvent Weld.
3. Above ground, 2 inches diameter and larger:
   a. Pipe: Cast Iron Drainage Pipe.
   b. Fittings: Cast Iron DWV.
   c. Joints: No hub.
4. Buried:
   a. Pipe: Cast Iron Drainage Pipe.
   b. Fittings: Cast Iron DWV.
   c. Joints: Hub and Spigot.

D. System 4 - Condensate and Equipment Drains:

1. Piping symbol and service:
   a. CD – Condensate Drain.
2. Above Ground (gravity drainage):
   a. Pipe: DWV grade PVC.
   b. Fittings: DWV PVC.
   c. Joints: Solvent Weld.
3. Above ground (pumped):
   a. Pipe: Schedule 40 PVC or CPVC (for systems above 100 degrees F).
   b. Fittings: Schedule 40 PVC or CPVC to match pipe.
   c. Joints: Solvent weld.

END OF SECTION

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Gate valves.
2. Ball valves.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 22 05 03 - Pipe and Pipe Fittings - Plumbing Systems.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
   a. SP 67, Butterfly Valves.
   b. SP 70, Cast Iron Gate Valves, Flanged and Threaded Ends.
   c. SP 71, Cast Iron Swing Check Valves, Flanged and Threaded Ends.
   d. SP 80, Bronze Gate, Globe, Angle and Check Valves.
   e. SP 110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

B. For drinking water service, provide valves complying with NSF 61.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.
2. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. Provide Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Apollo Valves by Conbraco Industries, Inc.
2. Crane ChemPharma Energy.
3. DeZURICK/APCO/Hilton.
4. Milwaukee Valve Company.
5. NIBCO, Inc.
6. Stockham by Crane ChemPharma Energy.

2.2 GATE VALVES

A. 2 inches and Smaller: MSS SP 80, Class 125, bronze body, bronze trim, union bonnet, non-rising stem, hand-wheel, inside screw, solid wedge disc, solder ends.

B. 2-1/2 inches and Larger: MSS SP 70, Class 125, cast iron body, bronze trim, bolted bonnet, non-rising stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.

2.3 BALL VALVES

A. 2 inches and Smaller: MSS SP 110, 400 psi WOG, two piece bronze body, chrome plated brass ball, full port, teflon seats, blow-out proof stem, threaded ends with union, lever handle.

2.4 CHECK VALVES

A. Horizontal Swing Check Valves:

1. 2 inches and Smaller: MSS SP 80, Class 150, bronze body and cap, bronze seat, Buna-N disc, threaded ends.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install 3/4 inches ball valves with cap for drains at main shut-off valves, low points of piping, bases of vertical risers, and at equipment.

D. Install valves with clearance for installation of insulation and allowing access.

E. Provide access where valves and fittings are not accessible. Coordinate size and location of access doors.

F. Refer to Section 22 05 29 for pipe hangers.

G. Refer to Section 22 05 03 for piping materials applying to various system types.

3.2 VALVE APPLICATIONS

A. Install ball or gate valves for drain service at locations indicated on Drawings in accordance with this Section.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball valves for throttling, bypass, or manual flow control services.

D. Install spring loaded check valves on discharge of water pumps.

E. Install ball valves in domestic water systems for shut-off service.

F. Install ball valves in domestic water systems for throttling service.

END OF SECTION

SECTION 22 05 29

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Inserts.
4. Flashing.
5. Formed steel channel.

B. Related Sections include but are not necessarily limited to:

1. Section 07 84 00 - Firestopping.
2. Section 07 92 00 - Joint Sealants.
3. Section 22 05 03 - Pipe and Pipe Fittings - Plumbing Systems.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B31.1, Power Piping.
   b. B31.5, Refrigeration Piping.
   c. B31.9, Building Services Piping.
2. ASTM International (ASTM):
   a. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   b. E119, Standard Test Methods for Fire Tests of Building Construction and Materials.
   c. E814, Standard Test Method for Fire Tests of Through Penetration Fire Stops.
   d. F708, Standard Practice for Design and Installation of Rigid Pipe Hangers.
   e. E1966, Standard Test Method for Fire-Resistive Joint Systems.
3. American Welding Society (AWS):
   a. D1.1, Structural Welding Code - Steel.
4. FM Global (FM):
   a. Approval Guide, A Guide to Equipment, Materials & Services Approved By Factory Mutual Research For Property Conservation.
5. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
   a. SP 58, Pipe Hangers and Supports - Materials, Design and Manufacturer.
   b. SP 69, Pipe Hangers and Supports - Selection and Application.
   c. SP 89, Pipe Hangers and Supports - Fabrication and Installation Practices.
6. Underwriters Laboratories Inc. (UL):
   a. 263, Fire Tests of Building Construction and Materials.
   b. 723, Tests for Surface Burning Characteristics of Building Materials.
   c. 1479, Fire Tests of Through-Penetration Firestops.
   d. 2079, Tests for Fire Resistance of Building Joint Systems.
   e. Fire Resistance Directory.
7. Intertek Testing Services (Warnock Hersey Listed):
   a. WH - Certification Listings.

B. Perform Work in accordance with applicable authority for welding hanger and support attachments to building structure.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.

C. Product Data:

1. Hangers and Supports: Submit manufacturers catalog data including load capacity.
2. Firestopping: Submit data on product characteristics, performance and limitation criteria.

D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods sealed by a registered professional engineer.

E. Manufacturer's Installation Instructions:

1. Hangers and Supports: Submit special procedures and assembly of components.

F. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing Work of this section approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

B. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.6 ENVIRONMENTAL REQUIREMENTS

A. 01 61 00 - Common Products Requirements.

1.7 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.8 WARRANTY

A. Furnish five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Manufacturers:

1. Anvil International.
2. CADDY by nVent.
3. Carpenter & Paterson, Inc.
4. B-Line by Eaton.
5. Empire Industries, Inc.
6. ERICO by nVent.
7. Globe Pipe Hanger Products, Inc.
8. Haydon Corporation.
9. Hilti, Inc.

10. NIBCO, Inc.
11. PHD Manufacturing, Inc.
12. TOLCO by Eaton.

B. Plumbing Piping - DWV:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inches: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:

1. Conform to ASME B31.9.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inches: Carbon steel, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
4. Hangers for Hot Pipe Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
5. Hangers for Hot Pipe Sizes 6 inches and Larger: Adjustable steel yoke, cast iron roll, double hanger.
6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded spacers and hanger rods, cast iron roll.
8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hook.
9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamp.
10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron roll.
11. Vertical Support: Steel riser clamp.
12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
15. Copper Pipe Support: Copper-plated, Carbon-steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

1. Electro-galvanized or zinc-nickel plated after threads are cut.

2.3 INSERTS

A. Manufacturers:

1. CADDY by nVent.
2. Carpenter & Paterson, Inc.
3. B-Line by Eaton.

4. Hilti, Inc.
5. National Pipe Hanger Corporation.
6. Pipe Shields, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Company, Inc.
9. Simpson Strong-Tie Company, Inc.
10. TOLCO by Eaton.
11. Value Engineered Products.

B. 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.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:

1. Waterproofing: 5 pound/SQFT sheet lead.
2. Soundproofing: 1 pound/SQFT sheet lead.

D. Flexible Flashing: 47 MIL thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sealant: Acrylic.

2.6 MECHANICAL SLEEVE SEALS

A. Manufacturers:

1. Flexicraft Industries.
2. GPT Industries.
3. Proco Products, Inc.

B. Product Description: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between object and sleeve, connected with bolts and pressure plates causing rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.7 FORMED STEEL CHANNEL

A. Manufacturers:

1. Unistrut by Atkore International, Inc.
2. B-Line by Eaton.
3. ERICO by Pentair.

B. Product Description: Galvanized 12 gage thick steel. With holes 1-1/2 inches on center.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive sleeves.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install backing materials to arrest liquid material leakage.

D. Obtain permission from Engineer before using powder-actuated anchors.

E. Obtain permission from Engineer before drilling or cutting structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut flush with top of slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with ASME 31.9.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inches space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inches minimum vertical adjustment.

F. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

L. Provide clearance in hangers and from structure and other equipment for installation of insulation.

3.5 INSTALLATION - FLASHING

A. Provide flexible flashing and metal counterflashing where piping penetrates weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and seal, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inches sheet size. Fasten flashing to drain clamp device.

D. Seal floor drains watertight to adjacent materials.

E. Adjust storm collars tight to pipe with bolts; seal around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.6 INSTALLATION - SLEEVES

A. Exterior watertight entries: Seal with mechanical sleeve seals.

B. Set sleeves in position in forms. Provide reinforcing around sleeves.

C. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

D. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent work with [stuffing] [firestopping] insulation and sealant [airtight]. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

3.7 SCHEDULES

PIPE HANGER SPACING		
PIPE MATERIAL	MAXIMUM HANGER SPACING (FT)	HANGER ROD DIAMETER (IN)
ABS (All sizes)	4	3/8
Aluminum (All sizes)	10	1/2
Brass		
Cast Iron (All Sizes)	5	5/8
Cast Iron (All Sizes) with 10 feet length of pipe	10	5/8
CPVC, 1 inch and smaller	3	1/2
CPVC, 1-1/4 inches and larger	4	1/2
Copper Tube, 1-1/4 inches and smaller	6	1/2
Copper Tube, 1-1/2 inches and larger	10	1/2
Fiberglass	4	1/2
Glass	8	1/2
Polybutylene	2.67	3/8
Polypropylene	4	3/8
PVC (All Sizes)	4	3/8
Steel, 3 inches and smaller	12	1/2
Steel, 4 inches and larger	12	5/8

END OF SECTION

SECTION 22 05 53
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Pipe markers.
4. Labels.
5. Lockout devices.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. American Society of Mechanical Engineers (ASME):
   a. A13.1, Scheme for the Identification of Piping Systems.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

C. Maintain one copy of each document on site.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Product Data: Submit manufacturers catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

F. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. Provide Operation and Maintenance Manual submittals.
2. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

PART 2 - PRODUCTS

2.1 MANUFACTUERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Nameplates, Tags and Stencils:
   a. Brady Corporation.
   b. Panduit.
   c. Seton by Brady Corporation.
   d. National Band & Tag Company.
   e. Carlton Industries, LP.

2.2 NAMEPLATES

A. Laminated two-layer phenolic or DR (high impact) acrylic with engraved black letters on light contrasting background color.

1. Thickness: Minimum 1/16 inches.
2. Color: Manufacturer standard or as specified.

B. Alternate: Laminated three-layer plastic with engraved black letters on light contrasting background color.

1. Thickness: Minimum 60 mils.
2. Color: Manufacturer standard or as specified.

2.3 TAGS

A. Nonmetallic Tags:

1. Fiberglass reinforced engraved black letters on light contrasting background color.
   a. Tag size: Minimum 1-1/2 inches diameter.
   b. Thickness: Minimum 100 mils.
   c. Color: Manufacturer standard or as specified.

B. Metal Tags:

1. Aluminum or stainless steel disc with stamped letters and finished edges.
   a. Tag size: Minimum 1-1/2 inches diameter.
   b. Thickness: Minimum 0.035 inches (20 Ga).
   c. Color: Black color filled into stamped text with natural metal background.

C. Tag Chart: Typewritten letter size list of applied tags and location in anodized aluminum frame.

2.4 UNDERGROUND WARNING TAPE

A. Description: Polyethylene tape with metallic core for detection and location of piping with metal detector resistant to acids, alkalis and other soil components.

1. Size: 0.004 inches thick; 6 inches wide.
2. Color: As Specified.
3. Service Marking: Printed text as selected by Architect/Engineer in [black] [contrasting] color and repeated at maximum 40 inches intervals.

2.5 TRACER WIRE

A. 12 GA AWG.

B. Solid.

C. Waterproof type wire nuts.

D. Brass split bolts.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:

1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:

1. Manufacturers:
   a. Brady Corporation.
   b. Master Lock Company, LLC.
2. Steel device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Install identifying devices after completion of coverings and painting.

B. All identification devices to be printed by mechanical process. Hand printing is not acceptable.

C. Install nameplates with adhesive where equipment has sufficient surface area and texture.

1. Attach tags with 1/8 inches flat head screws where adhesive application is not suitable.
2. Attach tabs with plastic strap where screws should not or cannot penetrate substrate.

D. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.

E. Install tags using corrosion resistant chain. Number tags consecutively by location.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify air tanks, and water treatment devices with nameplates. Identify in-line pumps and other small devices with tags.

H. Tag single items of equipment enclosed in a housing or compartment on outside of housing.

1. Tag multiple items mounted inside a housing or compartment individually inside the housing.

I. Identify control panels and major control components outside panels with plastic nameplates.

J. Identify valves in main and branch piping with tags.

K. Tag automatic controls, instruments, and relays. Key to control schematic.

L. Identify piping, concealed or exposed, with pipe markers. Use tags on piping 3/4 inches diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. 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.

M. Tracer Wire:

1. Attach to buried nonmetallic pipe at maximum of 10 feet intervals with tape or tie-wraps.
2. Install continuously from structure to structure including valve boxes and buildings.
3. Splice wire with split bolts or wire nuts only as needed; use continuous strands of no less than 100 feet length.

3.3 SCHEDULES

A. Ductwork:

1. Install labels on all duct in accordance with Article 3.2.
    a. Stencils or self-adhesive labels.
2. Color Coding:
    a. Black lettering on yellow backgrouond:
        1) Supply Air, Outside Air or Makeup Air.
    b. White lettering on green background:
        1) Return Air, Exhaust Air and Relief Air.

B. Above Grade Piping:

1. Install labels on all piping in accordance with Article 3.2.
    a. Stencils or self-adhesive lablels.

2. Color Coding: Per ASME A13.1.
    a. Black lettering on yellow background:
        1) Hazardous, flammable or high temperature fluids:
            a) Domestic Hot Water.
            b) Domestic Hot Water Return.
    b. White lettering on red background:
        1) Fire quenching fluids:
            a) Fire Protection Water.
    c. White lettering on green background:
        1) Low temperature water:
            a) Domestic Cold Water.
            b) Tepid Water.
            c) Nonpotable Water.
    d. White lettering on blue background:
        1) Compressed Air.

C. Below Grade Piping
    1. Use underground warning tape in accordance with Article 3.2.
        a. Lettering: Mimimum: 1-1/4 inches.
        b. Wording:
            1) First line: “CAUTION CAUTION CAUTION”
            2) Second line: “BURIED (Pipe Descriptor) LINE BELOW”
        c. Pipe Descriptors and color coding:
            1) Natural Gas: Black lettering on yellow background.
            2) Sewer or Waste: Black Lettering on Green Background.
            3) Water (potable): Black lettering on blue background.
            4) Water (nonpotable): Black lettering on Green background.

D. Valves:
    1. Install on all automatic valves used in temperature controls:
        a. Label per Control Drawings.
    2. Utilize nonmetallic or metal tags.
        a. Use stainless steel metal tags only for corrosive areas.

E. Equipment:
    1. Provide nameplate or stencil as warranted per Article 3.2.
    2. Label with equipment tag as shown on the Drawings.
        a. Black lettering on white background.
    3. Provide OSHA warning sign for equipment that starts automatically.
    4. Label all equipment control panels located remote from unit.
    5. Label all thermostats with self-adhesive markers with tag of equipment served.

END OF SECTION

SECTION 22 20 00
PLUMBING FIXTURES AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plumbing fixtures, trim, and equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 23 05 13 - Common Motor Requirements for Plumbing and HVAC Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Americans with Disabilities Act (ADA):
   a. Accessibility Guidelines for Buildings and Facilities (ADAAG).
2. American National Standards Institute (ANSI):
   a. Z358.1, Emergency Eyewash and Shower Equipment.
3. American Society of Heating, Refrigerating and Air Conditioning Engineers/Illuminating Engineering Society of North America (ASHRAE/IESNA):
   a. 90.1 IP, Energy Standard for Buildings Except Low-Rise Residential Buildings.
4. American Society of Mechanical Engineers (ASME):
   a. A112.19.3, Stainless Steel Plumbing Fixtures (Designed for Residential Use).
5. American Society of Sanitation Engineers (ASSE):
   a. 1011, Performance Requirements for Hose Connection Vacuum Breaker.
6. Canadian Standards Association (CSA).
7. NSF International (NSF).
8. Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 22 05 03.
2. Color selection charts for Owner color selection.
3. Fabrication and/or layout drawings:
   a. Layout plan(s) showing dimensions, elevations, etc.
   b. Details showing connections, installation, rough-in locations, etc.
4. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Chemical-resistance data.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. Provide Operation and Maintenance Manual submittals.

1.4 WARRANTY

A. Provide full written description of manufacturer's warranty.

B. Water heaters shall be warranted in writing against failure due to leaks of heater body and element assembly under normal use and service for a minimum period of five years after date of Substantial Completion.

1. Electric heating element shall be warranted for a minimum period of one year.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Plumbing fixtures (vitreous china):
   a. American Standard.
   b. Crane.
   c. Kohler.
   d. Eljer.
2. Stainless steel sinks:
   a. Just Manufacturing.
   b. Elkay.
3. Premolded mop sinks:
   a. Powers - Fiat.
   b. Standard - Elsmer Granite Co.
   c. Williams.
   d. Florestone.
4. Water closet seats:
   a. Church.
   b. Beneke.
5. Lavatory fittings:
   a. American Standard.
   b. Chicago Faucets.
   c. Kohler.
   d. Sloan.
6. Mop sink fittings:
   a. American Standard.
   b. Chicago Faucets.
   c. Kohler.
7. Sink fittings:
   a. American Standard.
   b. Kohler.
   c. Just.
8. Drains, roof drains, carriers, and shock absorbers:
   a. Wade.
   b. Josam.
   c. Zurn.
   d. Smith.
9. Trap primer:
   a. Precision Plumbing Products.
10. Hydrants:

a. Wade.
b. Josam.
c. Smith.

11. Domestic water heater:
    a. A. O. Smith.
    b. Ruud.
    c. Rheem.
    d. State.
12. Reduced pressure backflow preventer:
    a. Watts.
    b. Febco.
    c. Clayton.

2.2 MANUFACTURED UNITS

A. See Plumbing Schedules and Diagrams Sheet, P-601, for more information and requirements.

B. Carriers:

1. Lavatories: Wade W-520 series.

C. Drains:

1. Floor drain (FD):
    a. Bottom outlet.
    b. Clamping seepage flange.
    c. Seepage openings.
    d. Size as shown on Drawings.
    e. Type: Cast iron body.
        1) FD-1 (unfinished area) sediment bucket, bucket shall support grate: Wade W-1200-TD.
        2) FD-2 (finished area) adjustable satin nickel bronze strainer: Wade W-1100.
        3) FD-3 (finished area with tile floor) adjustable satin nickel bronze square strainer: Wade W-1100-G.

D. Traps:

1. Floor and equipment drains:
    a. Same material and coating as the piping system.
    b. 3 inches minimum seal.
2. Fixture drains:
    a. 2 inches minimum seal.
    b. Cast brass.
    c. Chrome plated.
    d. Size as required.
3. Ventilation housing drains: Extra-deep seal sufficient to maintain seal against static pressure maintained in fan housing.

E. Trap Primer:

1. Body:
    a. All brass construction.
    b. 1/2 inches male NPT inlet.
    c. 1/2 inches female NPT outlet.
    d. Stainless steel debris screen.

e. Brass piston.
f. Trap primer distribution:
1) Up to 4 traps.
2) 2 inches copper body.
3) Brass outlet.

F. Cleanouts (CO):
1. Cleanouts for cast iron pipe:
a. Tapped extra heavy cast iron ferrule.
b. Calked into cast iron fittings.
c. Extra heavy brass neoprene seal screw plug with solid hexagonal nut.
2. Cleanouts for steel pipe: Extra heavy brass screw plug in drainage fittings.
3. Access housing with adjustable anchor flange and secured scoriated cast: Wade W-3800-MF.
4. Cleanouts turning out through walls and up through floor shall be made by long sweep ells or "y" and 1/8 bends with plugs and face or deck plates to conform to architectural finish in room.
a. Where definite finish is not indicated, wall plates shall be chrome-plated cast-brass and floor plates polished brass.
5. Code:
a. Provide cleanouts of same size as pipe up to 4 inches and not less than 4 inches for larger pipes.
b. Close access openings for concealed cleanouts with flush floor or flush wall cover plates or flush ceiling access panels.
c. Provide wall plates with chrome plated cast-brass round cleanout cover with flanged ring.
d. Provide screws which match cover plate material.
6. Cleanouts installed in floor with a resilient tile finish: Wade W-6000-TS.
7. Cleanouts installed in floor with ceramic tile, concrete, or Terrazzo finish: Wade W-6000-U.
8. Cleanouts installed in finished rooms flush with wall: Wade W-8480-S stainless steel.
9. Cleanouts installed in completely accessible pipe chases or where piping is exposed do not require special covers.
10. Cleanouts in floating floors: Wade 8300-MF housing and cover with 8550 cleanout body and closure plug or Smith 4250 or 4260 Series housing and cover with 4280 or 4290 Series cleanout body and closure plug.

G. Domestic Water Heater (DWH):
1. Electric tank type:
a. Size and capacity as scheduled.
b. UL listed.
c. Internal surfaces:
1) Glass-lined with alkaline borosilicate composition fused-to-steel.
2) Provide magnesium rods rigidly supported for cathodic protection.
d. Low watt density heating elements with zinc-plated copper sheath.
1) Provide thermostat with each element, high temperature cutoff and temperature and pressure relief valve.
e. Insulate tank with vermin-proof glass fiber insulation or equal.
f. Heavy gage steel jacket with baked enamel finish.
g. Warranty against corrosion for three year period.

h. Provide water heaters meeting ASHRAE/IESNA 90.1 [IP] [SI] for energy efficiencies.

H. Reduced Pressure Backflow Preventer:

1. Backflow preventers consist of two check valves, test cocks and relief valve, all assembled as an integral unit.
2. Reduced pressure backflow preventers Watts 909.
3. Backflow preventer to have threaded ends in sizes through 2 inches, flanged 2-1/2 inches and larger.
4. Pressure loss through backflow preventer not exceeding 14 psi at design flow.
5. Provide air gap and pipe discharge to within 6 inches of finished floor.

I. Water Meter:

1. As indicated of a type approved by Water Department.
   a. Coordinate meters furnished by Water Department as to type and size.
   b. Obtain and pay necessary permits and approvals required to complete installation of water service.
   c. Provide valve on each side of meter and 3/4 inches drain valve spilling over floor drain.
2. Install full sized bypass line around meter with a sealed valve approved by Water Department.
   a. Meters 2 inches and less: Threaded fittings.
   b. Meters 2-1/2 inches and larger: Flanged connections.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cross Connection: Do not install any plumbing components that will provide a cross connection between potable and non-potable or drainage systems.

B. Fixtures:

1. Install fixtures at locations indicated on Drawings and in compliance with local Codes.
2. Connect plumbing supply, drain and vent line sizes as shown on Drawings.
3. Set proper grounds to form secure base for each fixture and rigid setting.
4. Install fixtures except water closets with water supply above rim and with Code approved backflow preventers.
5. Seal fixture joints abutting walls and floors with silicone sealant.
6. Connect exposed traps and supply pipes for fixtures and equipment to rough piping systems at wall, unless otherwise specified.
7. Install emergency fixtures in accordance with ANSI Z358.1.

C. Drains:

1. Install drains at locations indicated on Drawings and in compliance with local Codes.
2. In quarry tile floors:
   a. 24 x 24 inches 6 pound lead sheet clamped to drain.
   b. Set 1-1/2 inches above structural slab for mortar set and 1/2 inches for thin set.
3. In uncovered concrete slabs:
   a. Install at the low points of surface areas to be drained or as indicated.
   b. Set tops of drains flush with the finished floor.
   c. Install drain flashing collar or a flange so that no leakage occurs between the drain and the adjoining surfaces.
   d. Maintain the integrity of waterproof membranes, where penetrated.

D. Wall Hydrants:

1. Install 24 inches above exterior grade.
2. Support units from the structure and mount flush with structure face.
3. Prior to final setting, fill the back of the face with a non-hardening silicone caulk and press firmly in place to stop infiltration and water leakage.
4. Install isolation valves in line to each wall hydrant.

E. Shock Absorbers:

1. Install on hot and cold water lines adjacent to each battery of fixtures or other equipment where indicated on Drawings.
2. Size as recommended by manufacturer for length of pipe served.
3. Locations having two fixtures or less, install capped air chamber 12 inches long on hot and cold water runouts to each fixture, same size as runout.
4. Runouts to hose bibbs and wall hydrants do not require air chambers.
5. Install units vertically on top of pipe or as detailed on the Drawings.

F. Cleanouts:

1. Install cleanouts:
   a. Above floor in each vertical riser that connects to horizontal branch below floor.
   b. At test tee to receive proper test plugs in each vertical riser at least every other floor.
   c. As required by local Code.

G. Wall Plates and Escutcheons: Install as specified in Specification Section 40 05 00 or this Specification Section.

H. Water Heater:

1. Install all water heaters in accordance with details, manufacturer's recommendations, and applicable Codes.
2. For units located on concrete pads, plumb level and orient to allow access to the controls, elements and other items requiring service.
3. Connect hot and cold water piping to the unit with line-size, isolation valves and dielectric unions.
4. Connect recirculating hot water to cold inlet piping with unions and valves at check valves as detailed.
5. Connect gas piping as detailed in accordance with Specification Section 40 05 00 and located so as not to interfere with the unit service.
6. Start up the unit and adjust all controls for proper temperature control and maximum efficiency.
7. Where indicated, install instantaneous electric water heaters in enclosure rated for area classification.
   a. Silicone seal all piping and wiring penetrations.

I. Reduce Pressure Backflow Preventer: Install on water lines as required by Code.

3.2 FIELD QUALITY CONTROL

A. Test piping and fixtures for leaks per Specification Section 40 05 00.

END OF SECTION

DIVISION 23

HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)

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SECTION 23 05 13

COMMON MOTOR REQUIREMENTS FOR HVAC AND PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment furnished for plumbing and HVAC systems.
2. Single phase motors for plumbing and HVAC equipment.
3. Three-phase motors for plumbing and HVAC equipment.
4. Motors shipped loose for installation in plumbing and HVAC equipment.

B. Related Sections include but are not necessarily limited to:

1. Section 07 92 00 - Joint Sealants.
2. Section 23 05 53 - Identification for HVAC, Ductwork, Piping, and HVAC Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Bearing Manufacturers Association (ABMA).
2. International Electrotechnical Commission (IEC).
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
4. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. ICS 6, Enclosures for Industrial Control and System.
   c. MG 1, Motors and Generators.
5. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC):
6. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR 1910, Occupational Safety and Health Standards, referred to herein as OSHA Standards.
7. Underwriters Laboratories, Inc. (UL):
   a. 508A, Standard for Industrial Control Panels.
   b. 698A, Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations.

1.3 SUBMITTALS

A. Shop Drawings:

1. Equipment technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Data sheets that include manufacturer's name and complete product model number.
      1) Clearly identify all optional accessories that are included.
   c. Equipment identification utilizing numbering system and name utilized in Drawings.
   d. Equipment installation details:
      1) Location of anchorage.
      2) Type, size, and materials of construction of anchorage.
      3) Anchorage setting templates.
      4) Manufacturer's installation instructions.

e. Equipment physical characteristics:
    1) Dimensions (both horizontal and vertical).
    2) Materials of construction and construction details.
    3) Shipping and operating weight.
    4) Duct and piping connection sizes, type and location.
f. Equipment lining and coatings:
    1) Equipment factory primer and paint data.
g. Operating characteristics:
    1) Utility requirements, natural gas, electric and other.
    2) Performance curves.
    3) Equipment capacity and efficiency.
h. Electric motors:
    1) Nameplate data.
    2) Performance data.
i. Control panels:
    1) Panel layout and construction.
    2) Control ladder diagrams.
    3) Nameplate schedule.
    4) Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.

B. Contract Closeout Information:
    1. Operation and Maintenance Data:
        a. Provide Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual equipment Specification Sections for acceptable manufacturers.

B. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
    1. Motors:
        a. ABB Baldor-Reliance.
        b. General Electric.
        c. Hyundai Heavy Industries.
        d. Marathon Electric.
        e. Siemens.
        f. TECO-Westinghouse.
        g. Toshiba U.S.
        h. U.S. Motors, Nidec Motor Corporation.
        i. WEG.

2.2 MANUFACTURED UNITS

A. Equipment: Refer to individual equipment Specification Sections for product requirements.

B. Electric Motors:
    1. Design for frequent starting duty equivalent to duty service required by driven equipment.
    2. Design for full voltage starting.

3. Design bearing life based upon actual operating load conditions imposed by driven equipment.
4. Size for altitude of Project.
5. Furnish with stainless steel nameplates which include all data required by NFPA 70 (NEC), Article 430.
6. Use of manufacturer's standard motor will be permitted on integrally constructed motor driven equipment specified by model number in which a redesign of the complete unit would be required in order to provide a motor with features specified.
7. AC electric motors less than 1/3 hp:
    a. Single phase, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
    c. Built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element with stainless steel enclosure.
8. AC electric motors 1/3 to 1 hp:
    a. Single or 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
        1) For single phase motors, provide built-in manual reset thermal protector or integrally mounted manual motor starter with thermal overload element.
9. AC electric motors 1-1/2 to 10 hp:
    a. 3 PH, 60 Hz, designed for the supply voltage shown on the Drawings.
    b. Permanently lubricated sealed bearings conforming to ABMA standards.
    c. For vertical motors provide 15 year, average-life thrust bearings conforming to ABMA standards.
10. Severe duty motor to have the following minimum features:
    a. All cast iron construction.
    b. Gasketed conduit box.
    c. Epoxy finish for corrosion protection.
    d. Hydroscopic varnish on windings for corrosion protection.
    e. Drain plug and breather.

C. NEMA Design Squirrel Cage Induction Motors:

1. Provide motors designed and applied in compliance with NEMA and IEEE for the specific duty imposed by the driven equipment.
2. Motors to meet NEMA MG 1 (NEMA Premium) local jurisdiction efficiencies.
3. Do not provide motors having a locked rotor kVA per HP exceeding the NEMA standard for the assigned NEMA code letter.
4. For use on variable frequency type adjustable speed drives, provide:
    a. Induction motors that are in compliance with NEMA MG 1, Part 31.
    b. Nameplate identification meeting NEMA MG 1, Part 31 requirements.
    c. Insulated drive end bearing on all motors.
    d. Shaft grounding ring on all motors:
        1) Factory installed, maintenance free, circumferential, bearing protection ring with conductive microfiber shaft contacting material.
        2) Electro Static Technology AEGIS SGR Bearing Protection Ring or approved equal.
5. Design motor insulation in accordance with NEMA standards for Class F insulation with Class B temperature rise above a 40 degrees C ambient.
6. Design motors for continuous duty.
7. Size motors having a 1.0 service factor so that nameplate HP is a minimum of 15% greater than the maximum HP requirements of the driven equipment over its entire operating range.

a. As an alternative, furnish motors with a 1.15 service factor and size so that nameplate HP is at least equal to the maximum HP requirements of the driven equipment over its entire operating range.

8. Motor enclosure and winding insulation application:
   a. The following shall apply unless modified by specific Specification Sections:

MOTOR LOCATION	MOTOR ENCLOSURE / WINDING INSULATION
Unclassified Indoor Areas	TEFC, Standard Insulation
Wet indoor Areas	TEFC, Standard Insulation
Wet outdoor Areas	TEFC, Extra Dip and Bake for Moisture
Corrosive Areas	TEFC, Severe/ Chemical Duty

NOTE: Provide TENV motors in the smaller horsepower ratings where TEFC is not available.

9. Provide oversize conduit box complete with clamp type grounding terminals inside the conduit box.

D. Submersible Motors: Refer to individual narrow-scope Specification Sections for submersible motor requirements.

E. V-Belt Drive:

1. Provide each V-belt drive with sliding base or other suitable tension adjustment.
2. Provide V-belt drives with a service factor of at least 1.6 at maximum speed.
3. Provide staticproof belts.

2.3 ACCESSORIES

A. Guards:

1. Provide each piece of equipment having exposed moving parts with full length, easily removable guards, meeting OSHA requirements.
2. Interior applications:
   a. Construct from expanded galvanized steel rolled to conform to shaft or coupling surface.
   b. Utilize non-flattened type 16 GA galvanized steel with nominal 1/2 inches spacing.
   c. Connect to equipment frame with hot-dip galvanized bolts and wing nuts.
3. Exterior applications:
   a. Construct from 16 GA stainless steel or aluminum.
   b. Construct to preclude entrance of rain, snow, or moisture.
   c. Roll to conform to shaft or coupling surface.
   d. Connect to equipment frame with stainless steel bolts and wing nuts.

B. Data Plate:

1. Attach a stainless steel data plate to each piece of rotary or reciprocating equipment.
2. Permanently stamp information on data plate including manufacturer's name, equipment operating parameters, serial number and speed.

C. Lifting Eye Bolts or Lugs:

1. Provide on all equipment 50 pounds or greater.
2. Provide on other equipment or products as specified in the narrow-scope Specification Sections.

2.4 FABRICATION

A. Design, fabricate, and assemble equipment in accordance with modern engineering and shop practices.

B. Manufacture individual parts to standard sizes and gages so that repair parts, furnished at any time, can be installed in field.

C. Furnish like parts of duplicate units to be interchangeable.

D. Ensure that equipment has not been in service at any time prior to delivery, except as required by tests.

E. Furnish equipment which requires periodic internal inspection or adjustment with access panels which will not require disassembly of guards, dismantling of piping or equipment or similar major efforts.

1. Quick opening but sound, securable access ports or windows shall be provided for inspection of chains, belts, or similar items.

F. Provide common, lipped base plate mounting for equipment and equipment motor where said mounting is a manufacturer's standard option.

1. Provide drain connection for 3/4 inches PVC tubing.

G. Machine the mounting feet of rotating equipment.

H. Fabricate equipment which will be subject to Corrosive Environment in such a way as to avoid back to back placement of surfaces that can not be properly prepared and painted.

1. When such back to back fabrication can not be avoided, provide continuous welds to seal such surfaces from contact with corrosive environment.
2. Where continuous welds are not practical, after painting seal the back to back surfaces from the environment in accordance with Section 07 92 00.

I. Critical Speed:

1. All rotating parts accurately machined and in as near perfect rotational balance as practicable.
2. Excessive vibration is sufficient cause for equipment rejection.
3. Ratio of all rotative speeds to critical speed of a unit or components: Greater than 1.2.

J. Control Panels Engineered and Provided with the Equipment by the Manufacturer:

1. Manufacturer’s standard design for components and control logic unless specific requirements are specified in the specific equipment Specification Section.
2. NEMA or IEC rated components are acceptable, whichever is used in the manufacturer’s standard engineered design, unless specific requirements are required in the specific equipment Specification Section.
3. Affix entire assembly with a UL 508A or UL 698A label "Listed Enclosed Industrial Control Panel" prior to delivery.
    a. Control panels without an affixed UL 508A or UL 698A label shall be rejected.
4. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.
    a. Determine the SCCR rating by one of the following methods:
        1) Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
        2) Method 2: SCCR rating meets or exceeds the source equipment’s Amp Interrupting Current (AIC) rating as indicated on the Drawings.
        3) Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.

b. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the control panel circuit originates.

c. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

2.5 SOURCE QUALITY CONTROL

A. The Owner reserves the right to select and have tested any motor included within the project.

1. If motor passes testing requirements, the Owner shall be responsible for any shipping and testing costs incurred.
2. Costs shall be determined by current freight rates and manufacturer's published rates at the time of the test.
3. If motor fails test, Supplier shall be responsible for all costs incurred.
4. If two successive motors fail the test, the Owner has the right to reject any or all motors from that manufacturer.
5. The Owner also reserves the right to witness any routine or complete tests at the Owner's expense.
6. Notify the Owner a minimum of 14 days in advance of the testing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install equipment as shown on Drawings and in accordance with manufacturer's directions.

B. Utilize templates for anchorage placement for slab-mounted equipment.

C. For equipment having drainage requirements such as condensate, provide 3/4 inches PVC or clear plastic tubing from equipment base to nearest floor or equipment drain.

1. Route clear of major traffic areas and as approved by Engineer.

D. Extend all non-accessible grease fittings using stainless steel tubing to a location which allows easy access of fittings from closest operating floor level.

E. Equipment Base:

1. Construct level in both directions.
2. Take particular care at anchor bolt locations so these areas are flat and level.

F. Machine Base:

1. Mount machine base of rotating equipment on equipment base.
   a. Level in both directions, using a machinist level, according to machined surfaces on base.
2. Level machine base on equipment base and align couplings between driver and driven unit using steel blocks and shims.
   a. Size blocks and shims to provide solid support at each mounting bolt location.
      1) Provide area size of blocks and shims approximately 1-1/2 times area support surface at each mounting bolt point.
   b. Provide blocks and shims at each mounting bolt.
      1) Furnish blocks and shims that are square shape with "U" cut out to allow blocks and shims to be centered on mounting bolts.
   c. After all leveling and alignment has been completed and before grouting, tighten mounting bolts to proper torque value.

G. Couplings:

1. Align in the annular and parallel positions.

a. For equipment rotating at 1200 rpm or less, align both annular and parallel within 0.001 IN tolerance for couplings 4 inches size and smaller.
    1) Couplings larger than 4 inches size: Increase tolerance 0.0005 inches per inches of coupling diameter, i.e., allow 6 inches coupling 0.002 inches tolerance, and allow a 10 inches coupling 0.004 inches tolerance.
b. For equipment rotating at speeds greater than 1200 rpm allow both annular and parallel positions within a tolerance rate of 0.00025 inches per inch coupling diameter.

2. If equipment is delivered as a mounted unit from factory, verify factory alignment on site after installation and realigned if necessary.
3. Check surfaces for runout before attempting to trim or align units.

H. Grouting:

1. After machine base has been shimmed, leveled onto equipment base, couplings aligned and mounting bolts tightened to correct torque value, place a dam or formwork around base to contain grouting between equipment base and equipment support pad.
    a. Extend dam or formwork to cover leveling shims and blocks.
    b. Do not use nuts below the machine base to level the unit.
2. Saturate top of roughened concrete subbase with water before grouting.
    a. Add grout until entire space under machine base is filled to the top of the base underside.
    b. Puddle grout by working a stiff wire through the grout and vent holes to work grout in place and release any entrained air in the grout or base cavity.
3. When the grout has sufficiently hardened, remove dam or formwork and finish the exposed grout surface to fine, smooth surface.
    a. Cover exposed grout surfaces with wet burlap and keep covering sufficiently wet to prevent too rapid evaporation of water from the grout.
    b. When the grout has fully hardened (after a minimum of seven (7) days) tighten all anchor bolts to engage equipment base to grout, shims, and equipment support pad.
    c. Recheck driver-driven unit for proper alignment.

3.2 INSTALLATION CHECKS

A. For all equipment specifically required in detailed specifications, secure services of experienced, competent, and authorized representative(s) of equipment manufacturer to visit site of work and inspect, check, adjust and approve equipment installation.

1. In each case, representative(s) shall be present during placement and start-up of equipment and as often as necessary to resolve any operational issues which may arise.

B. Secure from equipment manufacturer's representative(s) a written report certifying that equipment:

1. Has been properly installed and lubricated.
2. Is in accurate alignment.
3. Is free from any undue stress imposed by connecting piping or anchor bolts.
4. Has been operated under full load conditions and that it operated satisfactorily.
    a. Secure and deliver a field written report to Owner immediately prior to leaving jobsite.

C. No separate payment shall be made for installation checks.

1. All or any time expended during installation check does not qualify as Operation and Maintenance training or instruction time when specified.

3.3 WIRING CONNECTIONS AND TERMINATION

A. Clean wires before installing lugs and connectors.

B. Coat connection with oxidation eliminating compound for aluminum wire.

C. Terminate motor circuit conductors with copper lugs bolted to motor leads.

D. Tape stripped ends of conductors and associated connectors with electrical tape.

   1. Wrapping thickness shall be 150% of the conductor insulation thickness.

E. Connections to carry full ampacity of conductors without temperature rise.

F. Terminate spare conductors with electrical tape.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC, DUCTWORK, PIPING AND HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nameplates.
2. Tags.
3. Labels.
4. Lockout devices.

B. Related Sections include but are not necessarily limited to:

1. Section 09 96 00 - High Performance Industrial Coatings.

1.2 QUALITY ASSURANCE

A. Reference Standards:

1. American Society of Mechanical Engineers (ASME):
   a. A13.1, Scheme for the Identification of Piping Systems.

B. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

C. Maintain one copy of each document on site.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog literature for each product required.

B. Shop Drawings: Submit Identification Register including list of wording, symbols, letter size, and color coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

D. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. See Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
2. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.4 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 MANUFACTUERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Nameplates, Tags and Stencils:
   a. Brady Corporation.
   b. Panduit.
   c. Seton by Brady Corporation.

d. National Band and Tag Company.
e. Carlton Industries, LP.

2.2 NAMEPLATES

A. Laminated two-layer phenolic or DR (high impact) acrylic with engraved black letters on light contrasting background color.
   1. Thickness: Minimum 1/16 inches.
   2. Color: Manufacturer standard or as specified.

B. Alternate: Laminated three-layer plastic with engraved black letters on light contrasting background color.
   1. Thickness: Minimum 60 mils.
   2. Color: Manufacturer standard or as specified.

2.3 SELF ADHESIVE PIPE AND DUCT MARKERS

A. Color and Lettering: Conform to ASME A13.1.

B. Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.
   1. Thickness: Minimum 5 mils.
   2. Letter Height:
      a. Up to 2 inches Outside Diameter of Insulation or Pipe: 1/2 inches high letters.
      b. 2-1/2 to 6 inches Outside Diameter of Insulation or Pipe: 1 inch high letters.
      c. Over 6 inches Outside Diameter of Insulation or Pipe: 1-3/4 inches high letters.
      d. Ductwork and Equipment: 1-3/4 inches high letters.
   3. Indoor/outdoor grade.
   4. Weather and UV resistant inks.
   5. Permanent adhesive.

2.4 UNDERGROUND WARNING TAPE

A. Description: Polyethylene tape with metallic core for detection and location of piping with metal detector resistant to acids, alkalis and other soil components.
   1. Size: 0.004 inches thick; 6 inches wide.
   2. Color: As selected.
   3. Service Marking: Printed text as selected by Architect/Engineer in black color and repeated at maximum 40 inches intervals.

2.5 TRACER WIRE

A. 12 GA AWG.

B. Solid.

C. Waterproof type wire nuts.

D. Brass split bolts.

2.6 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Anodized aluminum hasp with erasable label surface; size minimum 7-1/4 x 3 inches.

B. Valve Lockout Devices:
   1. Manufacturers:
      a. Brady Corporation.
      b. Master Lock Company, LLC.

2. Steel device preventing access to valve operator, accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 96 00 for stencil painting.

3.2 INSTALLATION

A. Apply stencil painting in accordance with Section 09 96 00.

B. Install identifying devices after completion of coverings and painting.

C. All identification devices to be printed by mechanical process. Hand printing is not acceptable.

D. Install nameplates with adhesive where equipment has sufficient surface area and texture.

1. Attach tags with 1/8 inches flat head screws where adhesive application is not suitable.
2. Attach tabs with plastic strap where screws should not or cannot penetrate substrate.

E. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.

F. Install tags using corrosion resistant chain. Number tags consecutively by location.

G. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

H. Identify air handling units, pumps, heat transfer equipment, tanks, and water treatment devices with nameplates. Identify in-line pumps and other small devices with tags.

I. Tag single items of equipment enclosed in a housing or compartment on outside of housing.

1. Tag multiple items mounted inside a housing or compartment individually inside the housing.

J. Identify control panels and major control components outside panels with plastic nameplates.

K. Identify valves in main and branch piping with tags.

L. Identify air terminal units and radiator valves with numbered tags.

M. Tag automatic controls, instruments, and relays. Key to control schematic.

N. Identify piping, concealed or exposed, with pipe markers. Use tags on piping 3/4 inches diameter and smaller. Identify service, flow direction, and pressure. Install in clear view and align with axis of piping. 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.

O. For exposed natural gas lines other than steel pipe, attach yellow pipe labels with "GAS" in black lettering, at maximum 5 feet spacing.

P. Identify ductwork with nameplates. Identify service and direction. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction and change of direction and not to exceed 20 feet spacing on straight runs.

Q. Tracer Wire:

1. Attach to buried nonmetallic pipe at maximum of 10 feet intervals with tape or tie-wraps.
2. Install continuously from structure to structure including valve boxes and buildings.
3. Splice wire with split bolts or wire nuts only as needed; use continuous strands of no less than 100 feet length.

3.3 SCHEDULES

A. Ductwork:

1. Install labels on all duct in accordance with Article 3.2.
    a. Stencils or self-adhesive labels.
2. Color Coding:
    a. Black lettering on yellow backgrouond:
        1) Supply Air, Outside Air or Makeup Air.
    b. White lettering on green background:
        1) Return Air, Exhaust Air and Relief Air.

B. Below Grade Piping

1. Use underground warning tape in accordance with Article 3.2.
    a. Lettering: Mimimum: 1-1/4 inches.
    b. Wording:
        1) First line: “CAUTION CAUTION CAUTION”
        2) Second line: “BURIED (Pipe Descriptor) LINE BELOW”
    c. Pipe Descriptors and color coding:
        1) Natural Gas: Black lettering on yellow background.
        2) Water (potable): Black lettering on blue background.
        3) Water (nonpotable):Black lettering on Green background.
        4) Miscellaneous (refrigerant, heating, cooling, etc): Black lettering on yellow background.
            a) Second line: “BURIED PIPE LINE BELOW’

C. Equipment:

1. Provide nameplate or stencil as warranted per Article 3.2.
2. Label with equipment tag as shown on the Drawings.
    a. Black lettering on white background.
3. Provide OSHA warning sign for equipment that starts automatically.
4. Label all equipment control panels located remote from unit.
5. Label all thermostats with self-adhesive markers with tag of equipment served.

END OF SECTION

SECTION 23 05 93
HVAC SYSTEMS - BALANCING AND TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Adjusting, balancing, and testing of all heating, ventilating and air conditioning (HVAC) systems, including the following systems:
   a. Air distribution and exhaust systems.
   b. Air moving equipment.
   c. Refrigeration system.

B. Related Sections include but are not necessarily limited to:

1. Section 23 09 00 - Instrumentation and Control for HVAC Systems.
2. Section 23 31 00 - HVAC - Ductwork.
3. Section 23 80 00 - HVAC - Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Associated Air Balance Council (AABC):
   a. National Standards for Total System Balance.
2. American Industrial Hygiene Association (AIHA):
   a. Z9.5, Laboratory Ventilation.
3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
   a. HVAC Applications Handbook, Chapter entitled "Laboratories".
   b. HVAC Systems and Equipment Handbook, Chapter entitled "Testing, Adjusting, and Balancing".
4. National Environmental Balancing Bureau (NEBB):
   a. Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Qualifications:

1. Work of this Section to be accomplished by an independent testing and balancing firm certified by one (1) of the following:
   a. Associated Air Balance Council (AABC).
   b. National Environmental Balancing Bureau (NEBB).
   c. Other certification entity approved by Engineer.
2. The independent firm shall not be the same firm as the firm installing the HVAC equipment, nor under contract to the firm installing the equipment.

1.3 SUBMITTALS

A. Shop Drawings:

1. Certifications:
   a. Letter stating the name and qualifications of the firm proposed.
   b. Evidence that relevant subcontractors have been notified of the requirement to coordinate balance and test elements in the work with the testing and balancing firm.
2. Report forms:
   a. Procedures and forms to be used in calibrating of test instruments, balancing systems, and recording and reporting test data.

B. Informational Submittals:

1. Completed test reports and data forms upon completion of installation, balance and testing of HVAC systems.
    a. Insert recorded information on report forms required by specifications and approved for use on project.
    b. Additional written verification and other related information clearly identifying project, date and specifics of verification.
    c. Utilize report forms similar to those shown in Section V of AABC Standard.
    d. Provide forms typed and signed by the testing and balancing firm.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Secure approved Shop Drawings of all HVAC equipment.

B. Procedures and Forms:

1. Submit procedures and forms to be used in calibration of test instruments, balancing systems, and recording and reporting test data.
2. Obtain approval before beginning balancing and testing.

C. Do not begin balancing and testing until HVAC systems are complete and in full working order.

1. Place HVAC systems into full operation and continue their operation during each working day of balancing and testing.

D. Provide qualified heating and ventilating Engineer(s) to supervise and perform balancing and testing.

E. Review design Drawings, specifications, approved Shop Drawings and other related items to become thoroughly acquainted with the design of HVAC systems.

F. Check all installed systems against Contract Drawings, Specifications and Shop Drawings to see that system is installed as required.

1. Report deficiencies to the Engineer.
2. Report deficiencies to Contractor for remedial action including providing corrective measures required in the function of any part of system to complete balancing.

G. Make necessary adjustments as required to balance the systems.

3.2 FIELD QUALITY CONTROL

A. Balance and Test Air Systems:

1. Adjust equipment RPM to design requirements.
2. Report motor full load amperes.
3. Obtain design CFM at fans.
    a. Make pitot tube traverse of main supply and exhaust ducts within 5%.
4. Test and record system static pressures, suction and discharge.
5. Obtain design CFM for recirculated air.
6. Obtain design CFM outside air.
7. Test and record entering air temperatures, (DB, heating and cooling).
8. Test and record leaving air temperatures, (DB, heating and cooling).
9. Test and record leaving air temperatures, (WB, cooling).
10. Adjust dampers in supply, exhaust and return air ducts to design CFM.

11. Test diffusers, grilles, and registers as follows:
    a. Adjust to comply with design requirements within 10%.
    b. Identify location and area of each.
    c. Adjust face velocity to establish required CFM.
        1) Retest after initial adjustments.
    d. Adjust to minimize drafts and to ensure uniform air distribution in all areas.
12. Identify and list size, type and manufacturer of diffusers, grilles, registers, and HVAC equipment.
    a. Use manufacturer's ratings on equipment to make required calculations.
13. Adjust and assure that the operation of automatically operated dampers are as specified.
    a. Check and calibrate controls.
14. Prepare and submit reports.

END OF SECTION

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SECTION 23 07 00
PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Insulation:
   a. Piping insulation.
   b. Duct insulation.
   c. Equipment insulation.
2. Adhesives, mastics, sealants, and finishes.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 22 05 03 - Pipe and Pipe Fittings - Plumbing Systems.
2. Section 23 31 00 - HVAC - Ductwork.
3. Section 23 34 00 - HVAC -Fans.
4. Section 23 74 36 - Refrigerant Piping System.
5. Section 23 80 00 - HVAC - Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C177, Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of Guarded-Hot-Plate Apparatus.
   b. C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
   c. C423, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   d. C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
   e. C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   f. C1071, Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
   g. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
   h. E96, Standard Test Methods for Water Vapor Transmission of Materials.
   i. F25, Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas.
   j. C518, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
   l. E119 Standard Method of Fire Tests of Building Construction, 2 Hour Wall Panel Test, 2 Hour External Total Engulfment Test, hose stream evaluation.
   m. E136, Combustion Characteristics of Building Materials in a Vertical Tube Furnace.
   n. E162, Surface Flammability of Materials.
   o. E814, Through-Penetration, 2-Hour Firestop Test.
   p. E2336: Standard Test Methods Fire Resistive Grease Duct Enclosure Systems.

2. ISO 6944-1985, Method of Determining Fire Resistance of Ventilation Ducts.
3. National Fire Protection Association (NFPA):
    a. 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
4. Underwriters Laboratories, Inc. (UL):
    a. 723, Standard for Test for Surface Burning Characteristics of Building Materials.
5. National Commercial and Industrial Insulation Standards (2013 seventh edition).
    a. Published by Midwest Insulation Contractors Association (MICA).
    b. Endorsed by National Insulation Association (NIA).
    c. MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
    c. Submit complete specification of insulation materials, adhesives, cement, together with manufacturer's recommended methods of application and coverage for coatings and adhesives.
2. Submit itemized schedule by building of proposed insulation systems showing density, thermal conductivity, thickness, adhesive, jackets and vapor barriers.
3. Certifications: Products will meet the requirements of the Contract Documents.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Elastomeric insulation:
    a. Rubatex.
    b. Armstrong.
2. Fiberglass insulation:
    a. CertainTeed Corporation.
    b. Johns Manville.
    c. Owens Corning.
    d. Knauf.
3. PVC jacket:
    a. Ceel-Co.
    b. PIC Plastics.
4. Equipment insulation:
    a. CertainTeed Corporation.
    b. Johns Manville.
    c. Owens Corning.
5. Ductwork insulation:
    a. CertainTeed.
    b. Johns Manville.
    c. Owens Corning.
6. High density perlite:
    a. Johns Manville.

b. Industrial Insulation Group (LIC).

7. High density calcium silicate:
   a. Industrial Insulation Group (LIC).
8. Adhesives, mastics, sealants, and finishes:
   a. Foster Products.
   b. Childers.
   c. Dow Corning.
   d. Johns Manville.
   e. Knauf.

2.2 PIPING INSULATION - ELASTOMERIC

A. General:

1. Insulation fire and smoke hazard ratings for composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation), as tested by procedure ASTM E84, NFPA 255 and UL 723, not exceeding:
   a. Flame spread: 25.
   b. Smoke developed: 50.
2. Accessories (adhesives, mastics, cements, and tapes: Same component ratings as listed above.
3. Indicate on product labels or their shipping cartons: Flame and smoke ratings do not exceed above requirements.
4. Permanent treatment of jackets or facings to impart flame and smoke safety is required.
   a. Water-soluble treatments are prohibited.
5. Insulated shields at pipe support points.

B. Pipe, Fitting, and Valve Insulation:

1. Flexible elastomeric closed cell pipe insulation.
   a. Average thermal conductivity not to exceed 0.27 (BTU-IN)/(HR-FT^2-DEGF) at mean temperature of 75 degrees F, temperature range -40 to 220 degrees F; permeability not to exceed 0.20 by ASTM E96; water absorption 3% by ASTM D1056 and ozone resistance.
2. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.3 PIPING INSULATION - FIBERGLASS

A. Pipe and Fitting Insulation:

1. Preformed fiberglass pipe insulation:
   a. Density: 4 pounds/CUFT.
   b. Temperature rated: 650 degrees F.
   c. Average thermal conductivity not to exceed 0.23 (BTU-IN)/(HR-FT^2-DEGF) at mean temperature of 75 degrees F.
   d. Fire hazard rating:
      1) UL 723, ASTM E84, NFPA 255.
      2) Flame spread not exceeding 25 and smoke developed not exceeding 50.
2. Moisture adsorption:
   a. ASTM C553.
   b. Not greater than 5% moisture by volume when exposed to moisture laden air at 120 degrees F and 96% RH.
3. Fungi and bacteria resistance:

a. ASTM C665.
b. Does not breed or promote growth.
c. Flame attenuated glass fibers bonded with thermosetting resin.

4. Piping jackets (general applications):
   a. Aluminum: 16 mil embossed aluminum.
   b. PVC: Preformed 0.028 inches thick PVC jackets fabricated from Johns Manville, or approved equal, PVC sheeting V-66 with proven resistance to ultraviolet degradation when temperatures do not exceed the limits of PVC.
   c. Piping jacket not required on concealed piping.
5. Provide minimum insulation thickness conforming to schedules or as shown on the Drawings.

2.4 PIPE INSULATION INSERTS AT HANGERS

A. High Density Perlite:

1. Pre-formed.
2. Fire hazard rating:
   a. UL 723, ASTM E84, NFPA 255.
   b. Flame spread: Zero.
   c. Smoke developed: Zero.
3. Average density: 13 pounds/CUFT.
4. Compressive strength: 80 psi to produce 5% compression.
5. Maximum surface temperature: 1,200 degrees F.

B. High Density Calcium Silicate:

1. Pre-formed.
2. Fire hazard rating:
   a. UL 723, ASTM E84, NFPA 255.
   b. Flame spread: Zero.
   c. Smoke developed: Zero.
3. Average density: 14 pounds/CUFT.
4. Compressive strength: 100 psi to produce 5% compression.
5. Maximum surface temperature: 1,200 degrees F.

2.5 EQUIPMENT INSULATION

A. Insulation for Equipment:

1. Fire hazard classification:
   a. UL 723, ASTM E84, NFPA 255.
   b. Flame spread not exceeding 25 and smoke developed not exceeding 50.
2. Provide minimum insulation thickness conforming to Schedules, or as shown on Drawings.

2.6 DUCTWORK INSULATION: FIBERGLASS

A. Flexible Insulation:

1. Material: Commercial-grade fiberglass thermal insulation, formaldehyde free.
2. Scheduled thickness and installed R-value. Installed R-value when compressed to a maximum of 25% following recommended duct wrap stretch outs.
3. Factory-applied foil scrim vapor barrier facing.
4. Average thermal conductivity not to exceed 0.27 (BTU-IN)/(HR-FT^2-DEGF) at a mean temperature of 75 degrees F (installed).
5. Fungi and bacteria resistance:

a. ASTM C1338.
b. Does not breed or promote growth.

6. Fire hazard classification:
   a. UL 723, ASTM E84, NFPA 255.
   b. Flame spread not exceeding 25 and smoke developed not exceeding 50.
7. Basis of design: Johns Manville Microlite fiberglass duct wrap insulation.

B. Semi-Rigid Insulation for Indoor Installation:

1. Scheduled thickness and R-value.
2. Factory applied vapor barrier facing-white scrim foil.
3. Average thermal conductivity not to exceed 0.23 (BTU-IN)/(HR-FT^2-DEGF) at a mean temperature of 75 degrees F.
4. Fungi and bacteria resistance:
   a. ASTM C1338.
   b. Does not breed or promote growth.
5. Moisture adsorption:
   a. ASTM C553.
   b. Not greater than 0.5% moisture by volume when exposed to moisture laden air at 120 degrees F and 96% RH.

C. Semi-Rigid Insulation for Outdoor Installation:

1. Scheduled thickness and R-value.
2. Factory-applied foil scrim vapor barrier facing.
3. Average thermal conductivity not to exceed 0.23 (Btu-IN)/(HR-FT^2-DegF) at mean temperature of 75 degrees F.
4. Minimum density: 3 pounds/CUFT.
5. Fungi and bacteria resistance:
   a. ASTM C1338.
   b. Does not breed or promote growth.
6. Basis of Design: Johns Manville #815 SPIN-GLASS fiberglass duct insulation.

D. Duct Interior Lining Board:

1. Acoustical performance: Minimum noise reduction coefficients (NRC) is 0.45 when tested in accordance with ASTM C423 on ASTM F25 mounting.
2. Fire hazard classification:
   a. UL 723, ASTM E84, NFPA 255.
   b. Flame spread not exceeding 25 and smoke developed not exceeding 50.
3. Service temperature:
   a. ASTM C411.
   b. Cooling and heating ducts up to 200 degrees F.
4. Velocity rating:
   a. ASTM C1071.
   b. Maximum average air velocity is rated at 600 fpm.
5. Moisture adsorption:
   a. ASTM C553.
   b. Not greater than 0.5% moisture by volume when exposed to moisture laden air at 120 degrees F and 96% RH.
6. Fungi and bacteria resistance:
   a. ASTM C1338.

b. Does not breed or promote growth.

7. Size and performance:
   a. ASTM C518 and ASTM C177.
   b. 1 inches thickness, long textiled glass-type fibers firmly bonded by thermosetting resin.
   c. At 75 degrees F mean temperature, the k value, expressed as (BTU-IN)/(HR-FT^2-DEGF) does not exceed 0.27.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. General:

1. Piping below ground covered with earth will not be insulated except as specified in Specification Section 22 05 03.
2. Consider ductwork, piping and equipment as exposed, except as otherwise indicated.
3. Consider ductwork, piping and equipment in walls, partitions, floors, pipe chases, pipe shafts and duct shafts as concealed.
   a. Consider ductwork, piping and equipment above ceilings as concealed.
4. Provide release for insulation application after installation and testing is complete.
   a. Apply insulation on clean, dry surfaces after inspection.
5. Provide insulation continuous through wall, roof and ceiling openings, pipe hangers, supports and sleeves.
6. Provide insulation with vapor barrier for piping, ductwork and equipment where surfaces may be cooler than surrounding air temperatures.
   a. Provide vapor barrier (0.17 perm-IN; ASTM C553) continuous and unbroken.
   b. Hangers, supports, anchors, and related items that are secured directly to cold surfaces must be adequately insulated and vapor-sealed to prevent condensation.
7. Apply specified adhesives, mastics and coatings at the manufacturer's recommended coverage per unit volume.

C. Piping Insulation - Elastomeric:

1. Do not insulate until satisfactory completion of required pressure testing.
2. Apply insulation to clean, dry surfaces.
3. Slip insulation on pipe prior to connection.
   a. Whenever the slip-on technique is not possible provide insulation neatly slit and snapped over the pipe.
4. Fabricate and install fitting cover insulation according to manufacturer's recommendations.
5. Seal joints, slits, miter-cuts and other exposed edges of insulation with adhesive, recommended by the insulation manufacturer, to ensure complete vapor barrier.

D. Piping Insulation - Fiberglass:

1. Apply over clean dry pipe.
   a. Butt all joints together firmly.
2. Seal joints, slits, miter-cuts and other exposed edges of insulation as recommended by the insulation manufacturer.
3. Insulate fittings, valves, and flanges with insulation thickness equal to adjacent pipe.
4. PVC pipe jacket:
   a. Apply jacketing with a minimum of 1 inch overlap.
      1) Weld longitudinal and circumferential seams with adhesives as recommended by manufacturer.

b. Provide slip-joints every 30 feet and between fittings if distance exceeds 8 feet.
    1) Construct slip-joints by overlapping jacket sections 6 to 10 inches.
c. Provide pre-molded PVC covers of same material and manufacturer as jacket for fittings, valves, flanges, and related items in insulated piping systems.

5. Aluminum pipe jacket:
a. Field-applied aluminum jacket with vapor-sealed longitudinal and butt joints.
b. Provide smooth and straight joint with a minimum 2 inches overlap.
c. Secure joints with corrosion-resistant screws spaced 0.25 to 0.50 inches back from edge.
d. Center spacing of screws 5 inches maximum or as required to provide smooth tight-fitted joints.
e. Place joints on least exposed side of piping to obtain neat appearance.

E. Equipment: Install per manufacturer's instructions.

F. Ductwork Insulation - Fiberglass:

1. Flexible insulation:
a. Butt edges tightly.
    1) Secure insulation with Benjamin Foster 85-20 adhesive applied in 6 inches strips on 12 IN centers and/or pins, applied on not more than 18 inches centers so that the insulation conforms to the duct surfaces uniformly and firmly.
b. Seal joints with facing overlap or 4 inches wide strips of like facing material adhered and stapled in place.
c. Properly seal any penetration in vapor barrier facing with Benjamin Foster 85-20.
d. Cut insulation slightly longer than the perimeter of the duct to ensure full thickness at corners.

2. Semi-rigid insulation and duct interior lining board:
a. Impaling over pins.
    1) Apply insulation with edges tightly butted.
    2) Apply insulation with mechanically welded fasteners to the duct and secured with speed clips.
    3) Clip pins off close to clip.
    4) Space pins as required to hold insulation firmly against duct surface but not less than one pin per 1.5 square feet.
    5) Seal joints and speed clips with 3 inches wide strip of facing adhered with Benjamin Foster 85-20 adhesive.
b. If the welded pin method is impossible, secure insulation to the duct with Benjamin Foster 85-20 adhesive.
    1) Cover the entire surface of duct with adhesive.
    2) Use corner metal angle to protect edge of insulation.
    3) Protect edge of insulation.
    4) Seal joints as above.
c. For outdoor application finish with Benjamin Foster #4610 weatherproof mastic with white glass fabric membrane.

G. Install interior duct lining board as indicated above.

1. Overall length shall be as indicated on the Drawings or a minimum of 10 linear foot past any type of air supply fan.

3.2 REPAIR

A. Whenever any factory applied insulation or job-applied insulation is removed or damaged, replace with the same quality of material and workmanship.

3.3 SCHEDULES

A. Refrigeration Lines (35-60 degrees F):

1. Elastomeric.
2. 1/2 inches thickness for lines 1 inch and smaller.

B. Pipe, Fittings and Valves:

1. Fiberglass.

APPLICATION	PIPE SIZE	THICKNESS	JACKET
Hot Water (domestic)	1-1/2 inches and less	1 inches	PVC
	Over 1-1/2 inches	1-1/2 inches	PVC
Cold Water (domestic)	All sizes	1 inches	PVC
Refrigeration Lines (35 - 60 degrees F)	All	1 inches	PVC
Condensate Vent	2 inches and less	1 inches	PVC
	2-1/2 inches to 6 inches	1-1/2 inches	
	Over 6 inches	2 inches	

C. Equipment:

EQUIPMENT	INSULATION SYSTEM
Below drain pans serving cooling coils, pre-heat systems, domestic water heaters	1 inches flexible elastomeric closed cell sheet.
Cold water meter	Uninsulated

D. Ductwork:

1. Fiberglass.

DUCT SERVICE	INSULATION AND THICKNESS	MINIMUM R-VALUE $(HR\text{-}FT^2\text{-}DEGF)/BTU$
Outside air and supply air downstream of heat recovery units, outside building	2-1/2 inches semi-rigid for outdoor installation	12.0
Outside air ducts, inside building	2-1/2 inches semi-rigid with vapor barrier	12.0
Supply and return air ducts inside building	2 inches flexible with vapor barrier	6.0
Supply and return air ducts outside building and where exposed to atmospheric air	2-1/2 inches semi-rigid for outdoor installation	12.0
Return air duct in non-conditioned areas including shafts	2-1/2 inches flexible with vapor barrier	12.0

DUCT SERVICE	INSULATION AND THICKNESS	MINIMUM R-VALUE ($(HR\text{-}FT^2\text{-}DEGF)/BTU$)
Exhaust air ducts upstream of heat recovery units, inside building	1-1/2 inches semi-rigid	6.0
Exhaust air ducts upstream of heat recovery units, outside building	2-1/2 inches semi-rigid for outdoor installation	12.0
All other ductwork	Uninsulated	N/A

END OF SECTION

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SECTION 23 09 00
INSTRUMENTATION AND CONTROL FOR HVAC SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Instrumentation and control for HVAC systems.
2. Temperature control.
3. Ventilation control.
4. Heating control.
5. Cooling control.
6. Control wiring.
7. Panels and accessories.
8. Miscellaneous.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 23 05 13 - Common Motor Requirements for HVAC and Plumbing Equipment.
2. Section 23 31 00 - HVAC - Ductwork.
3. Section 23 80 00 - HVAC - Equipment.
4. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
5. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. See Specification Section 01 61 03.

B. Referenced Standards:

1. ASTM International (ASTM):
   a. D1693, Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics.
2. The International Society of Automation (ISA):
   a. S5.1, Instrumentation Symbols and Identification.
   b. S5.4, Standard Instrument Loop Diagrams.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
4. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL).

C. Miscellaneous:

1. Controls to be in compliance with Specification Section 26 05 00 for NEMA and NFPA 70 enclosure class requirements unless noted or specified otherwise.
2. Unless specifically noted otherwise, components of systems shall be industrial duty suitable for moist, corrosive environments.

1.3 SYSTEM DESCRIPTION

A. Work shall be provided as an integrated operating system.

B. Provide a complete system of automatic temperature control, thermostats, relays, valves, damper operators and other associated controls and appurtenances required to maintain

minimum conditions described in detail herein and on Drawings, together with thermometers, gages and other accessory equipment.

1. Assemble control system with complete system of wiring and air piping to fulfill requirements of the Contract Documents.

C. Install system using competent mechanics under direct supervision of control manufacturer.

D. Controls, as set out in "Sequence of Operation," are designed to illustrate operating functions only.

1. Control sequence shall be considered supplementary to "Sequence of Operation".
2. These minimum specified items, and any additional controls, not indicated but required to meet performance as outlined in the Contract Documents, shall be furnished and installed at no additional cost to Owner to make a complete system.

E. Sequence of Operation - General:

1. Sequence of operation indicated illustrates basic operating functions only.
2. Review Drawings and submit complete installation data, including minor details, to provide proper operation in his proposal.
3. Where an item differs from specifications, control manufacturer shall submit manufacturer's recommendations subject to Engineer's approval.

1.4 SUBMITTALS

A. Shop Drawings:

1. Wiring diagrams showing point to point termination with auxiliary interlocks for each item in each control loop.
2. Information on equipment proposed for use including corrosion protection.
3. Instrument loop diagrams and word description of loop function for each individual unit controlled including auxiliary interlocks in full compliance with ISA S5.4.
    a. Show components in system and ensure diagrams are in full compliance with ISA S5.1 (Instrumentation Symbols and Identification) and other related ISA standards.

B. Quality Control Submittals:

1. Secure from equipment manufacturers, detailed and complete control and power wiring diagrams, word descriptions of controls provided as part of the HVAC equipment or equipment interfaced or interlocked thereto, and submit with equipment manufacturer's submittals.
    a. Provide the above information to control manufacturer.

C. Contract Closeout Information:

1. Operation and Maintenance Data:
    a. Provide Operation and Maintenance Manual submittals.

1.5 SITE **CONDITIONS**

A. Unless stated otherwise, the environment and air streams will include varying concentrations of the following chemical components:

1. Condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Manufacturer's catalog numbers hereinafter are for reference to type, style, dimension, related items and to establish a standard of quality.

a. Reference to a manufacturer's number hereinafter does not imply full compliance to these Specifications.

2. Instrumentation and control systems:
   a. Honeywell.
   b. Johnson Control Co.

2.2 EQUIPMENT

A. Dampers:

1. Refer to Specification Section 23 31 00.

B. Damper Operators:

1. Provide operators of proper size and number to secure true throttling or two-position action as required.
2. Furnish damper operators for installation inside ductwork and attached to frame of damper, or installed outside ductwork and connected to extended shaft as required.
3. Provide operators for outside air, spring-loaded with sufficient power to assure tight closing of dampers on fan shutdown or in the fail safe position indicated by "Sequence of Controls."
4. Electric operators:
   a. Provide operators:
      1) Fully immersed in oil gear train.
      2) Enclosed in closed cast aluminum housing.
   b. As an alternate to 4.a.: Provide operators in NEMA 4X enclosure, Belimo ZS-300.
   c. Provide damper operators with integral spring return motor springs to make controls fail safe in position specified under "Sequence of Controls."
   d. Provide fully modulating operators from proportional electric controllers.
   e. Provide end switches or proportioning controllers permitting simultaneous operation or interlocking with other equipment.
   f. Provide separate electrical circuits for damper operators with no more than four operators on a circuit.
5. Coordinate with dampers provided:
   a. Provide damper operators that are rated for the required torque.
   b. If single damper operator can not meet torque requirement, provide sectional dampers to match operator torque.
6. Ensure coordination to provide for the installation of tight closing dampers low leakage type (6 cfm per square foot at 4 inches WC pressure across damper) with compatible dampers, damper operators and related controls.

C. Electric Control Instruments:

1. Provide stainless steel sensing elements type thermostats with liquid filled, compensated thermal systems so that equally spaced dial graduations are possible over entire range.
   a. Make thermal systems field detachable with averaging or plain bulbs as installation conditions dictate.
   b. Provide sensing elements minimum of 60 inches in length and suitable for operation from -30 to 300 degrees F.
   c. Provide reverse acting on-off type thermostats for controlling ventilating fans.
   d. Provide multiple stage thermostats where designated in Paragraph "Sequence of Operation".
2. Provide transformers for supplying current to control equipment operating at less than 120 V and where required by manufacturer's automatic control system design capable of supplying 125% of energy requirements of equipment connected for not less than 1 hour.
   a. Enclose transformers in UL listed cabinets with conduit connections.

b. Provide fused disconnect switches on both primary and secondary sides.

3. Provide low limit electric thermostats of two-position type with 20 feet bulb and manual reset.
   a. Shall be capable of opening thermostat circuit if any 1 foot section of bulb is subjected to a temperature below thermostat setting.
   b. Each thermostat shall have two circuits, one to shut down fan, another for alarm.
   c. Install all freeze-stats to override starter circuits regardless of position.
   d. For corrosive environments provide thermostats with stainless steel sensing elements.
      1) Ensure element is installed to sense coldest point should stratification occur.
4. Provide each thermostat with an accurate red-reading thermometer sensing temperature outside of enclosure.
5. Label thermostat with identification tag of HVAC equipment controlled using phenolic nameplate.

2.3 FABRICATION

A. Corrosion Protection:

1. Protect metal parts of controls, instrumentation and related items from corrosive atmosphere by either protective coatings or select materials.
   a. Aluminum and stainless steel require no further protection.
2. Provide NEMA 4X fiberglass control enclosures with tempered glass windows and vapor tight gaskets, illustrated in Hoffman Bulletin A-50, for protection of controls from corrosive environment.
   a. Install control instruments inside enclosure and extend remote stainless steel sensing elements through enclosure wall.
   b. Provide vaportight seals for penetrations of enclosure.
3. Provide in each enclosure industrial corrosion inhibitors, Hoffman Corrosion Inhibitors, as illustrated in Hoffman's technical Bulletin HCI.
4. Protect metal accessory items such as mounting brackets and fasteners not stainless steel, fiberglass or aluminum by epoxy or phenolic coatings.
5. Protect electric motor operator with corrosion inhibitors inside enclosure.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with requirements of Specification Section 26 05 19 and Specification Section 26 05 33.

B. Identification: See Specification Section 23 05 53.

C. Connect control devices to perform functions indicated and perform in required sequence.

D. Use remote element temperature transmitters for points of temperature transmitters for points of temperature measurement occurring in air ducts or shafts, or in mechanical piping system.

E. Use remote element pressure transmitters of panel-mounted pressure gages.

F. Where continuous indication of space temperature is on local control panels, install a thermostat and a temperature transmitter side by side.

1. Pipe continuous indication signal to a receiver on panel.
2. A resistance element or thermocouple signal may be used with continuous indicating meter, calibrated in degrees Fahrenheit.

G. In general, locate thermostats for room control immediately inside door, above light switch, unless shown otherwise.

1. Where light switch is in an entryway to room, locate thermostat on wall within room so it is capable of sensing true space conditions.

2. Prior to installation, coordinate thermostat location with Engineer.

H. Mount local control panels adjacent to equipment served.

I. Where a temperature indicating gage is used at the panel, a pressure gage indicating transmitter signal is not required.

J. Provide appropriate type continuous reading indicator for each controller, transmitter and transducer.

1. Mount in-line or tapped on controller.
2. Mount at local control panel.

K. Gages with flexible hose terminating with hypodermic needle may be used for checking control system.

1. Do not substitute for in-line gages.

L. Locate panels so visual observation and adjustment can be accomplished from floor level.

END OF SECTION

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SECTION 23 31 00
HVAC - DUCTWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. HVAC ductwork and accessories.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 08 90 00 - Louvers and Vents.
2. Section 23 05 13 - Common Motor Requirements for HVAC and Plumbing Equipment.
3. Section 23 07 00 - Pipe, Duct and Equipment Insulation.
4. Section 23 09 00 - Instrumentation and Control for HVAC Systems.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
   a. 52, Method of Testing Air Conditioning Devices Used in General Ventilation for Removing Particulate Matter.
2. National Fire Protection Association (NFPA).
3. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   a. Ducted Electric Heat Guide for Air Handling Systems.
   b. HVAC Duct Construction Standards - Metal and Flexible.
4. Underwriters Laboratory, Inc. (UL):
   a. 555, Standard for Safety Fire Damper and Ceiling Fire Damper.
   b. 555S, Standard for Safety Leakage Rated Dampers for Use in Smoke Control Systems.
   c. Building Materials Directory.

B. Qualifications:

1. Fabricator: Firms regularly engaged in the manufacture of the specific product, of type, size required, whose products have been in use in similar service for not less than three years.
2. Installers: Firm with at least five years installation experience on products similar to that required for this Project.

1.3 DEFINITIONS

A. Installer or Applicator:

1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
2. Installer and applicator are synonymous.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00.
2. Efficiency ratings per ASHRAE 52 for factory built and assembled filter units.
3. Scaled ductwork drawings (1/4 inches equals 1 foot) showing duct and accessory layout and support.

B. Contract Closeout Information:

1. Operation and Maintenance Data:

a. Provide Operation and Maintenance Manual submittals.

C. Miscellaneous Submittal:

1. Documentation of qualifications for fabricators and installers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Transverse joints (factory fabricated aluminum):
   a. Ductmate Industries, Inc.
2. Flexible ducts:
   a. Thermaflex.
   b. Condu-flex.
   c. Glass-flex.
3. Turning vanes:
   a. Ductmate Industries, Inc.
   b. Duro Dyne.
   c. SEMCO Incorporated.
   d. Ward Industries, Inc.
4. Flexible duct connections:
   a. Vent Fabrics.
   b. Duro Dyne.
5. Flexible connector thrust restraint:
   a. Mason WB.
6. Backdraft dampers:
   a. Air Balance.
   b. Ruskin.
   c. American Warming.
7. Ceiling diffusers:
   a. Anemostat.
   b. Carnes.
   c. Titus.
8. Grilles and registers:
   a. Anemostat.
   b. Carnes.
   c. Titus.
9. Air filters:
   a. American Air Filter.
   b. Farr.
   c. Continental.
10. Manual (volume) dampers:
    a. Air Balance.
    b. Ruskin.
    c. American Warming.
11. Duct sealers:

a. Durkee-Atwood.
b. Unitec McGill.
c. Benjamin Foster.
d. Design Polymerics.

12. Temperature control and automatic dampers:
    a. Air Balance.
    b. Ruskin.
    c. American Warming.
13. Louvers:
    a. Ruskin.
    b. Air Balance.
    c. American Warming.

2.2 COMPONENTS

A. Duct and Fittings (Metallic):

1. Materials:
    a. G90 galvanized steel:
        1) Comply with ASTM A653 and ASTM A90.
2. Fabrication (galvanized steel):
    a. Minimum Sheet Metal Thickness:
        1) Per SMACNA for 2 inches WC pressure class.
            a) Heavier gage sheet material may be used with associated reinforcement as an alternate to minimum thickness specified.
            b) Lighter gage sheet material with associated reinforcement shall not be used as an alternate to minimum thickness specified.
    b. Longitudinal Seams:
        1) Pittsburgh lock seam.
        2) Continuously Welded.
    c. Transverse Seams:
        1) SMACNA T-22 or T-24 companion flange.
        2) Factory fabricated flanged duct connection system:
            a) Ductmate 25/35.
            b) Angles and Cleates: Galvanized.
            c) Snap cleats: Galvanized.
            d) Gaskets: Close cell neoprene.
            e) Bolts and screws: Stainless.
    d. Sealing:
        1) Per SMACNA for Seal Class A.

B. Duct and fittings, Manufactured:

1. Material: Galvanized steel.
2. Spiral lockseam construction.
3. Reinforcing corrugations.
4. Material thickness:
    a. Straight runs: per SMACNA.
    b. Fittings: at least two gages heavier than straight runs.
5. Fittings:

a. All seams continuously welded.
b. All divide flow fittings discreet and separate, i.e. no tap collars.

6. Double wall:
   a. Outer wall: solid:
   b. Inner wall: perforated:
   c. Insulation: 1 inch fiberglass minimum.
      1) Minimum 'k-value': 0.27 btu/ h-FT2-DEGF.
      2) United McGill Acousti-k27 or approved equal.

C. Supports and Hangers:

1. Materials (for galvanized duct):
   a. Support angles: Galvanized or stainless steel, minimum 1-1/2 by 1-1/2 by 1/4 angle.
   b. Hanger rods: Galvanized or Stainless steel.
   c. Anchors: Stainless steel wedge type.
2. Fabrication: Trapeze type units.
3. Strap hangers are not allowed.

D. Turning Vanes:

1. Materials: Same as duct.
2. Fabrication:
   a. Fabricate double vane units.
   b. Pressure drop through elbows: Maximum 20% of velocity pressure.

E. Flexible Connections:

1. Materials: Hypalon, double coated closely woven glass fabric.
2. Fabrication: Withstand 4.5 inches water column, positive and negative pressure.

F. Volume Extractors:

1. Materials (for galvanized duct):
   a. Mounting bracket, movement bar and blades: 18 gage steel, coated.
2. Fabrication:
   a. Gang operated parallel blade, fully adjustable.
   b. Minimum two manually operated adjustment arms.
   c. Rotating shaft: Minimum 3/8 inches SQ.

G. Flexible Duct:

1. Material: Continuous steel supporting spiral covered with 100% continuous filament fiberglass with nonporous fiberglass/vinyl liner and reinforced Mylar/neoprene outer cover.
2. UL listed, Class 1 with flame spread of 25 or less and smoke development rating not to exceed 50.

H. Drain Pan:

1. Materials: Aluminum.
2. Fabrication: 0.080 inches.

I. Backdraft Dampers:

1. Material:
   a. G90 galvanized steel.
   b. Blade edge seals: Extruded vinyl.
2. Fabrication:

a. Frame thickness: 0.125 inches / 16 gage minimum.
b. Blade thickness: 0.070 inches / 18 gage minimum.
c. Linkage: 1/2 inches tie bars.
d. Bearings: Synthetic.

J. Diffusers:

1. Materials:
   a. Body: Extruded aluminum.
   b. Ceiling diffuser gaskets: Sponge rubber.
2. Fabrication:
   a. Type: Square or rectangular with removable core.
   b. Key operated opposed blade damper mounted in neck except where indicated on Drawings to be omitted.
      1) Dampers to be housed in round to square adapters.
   c. Linear supply diffusers:
      1) Internal pattern control vanes which also function as volume control dampers, adjustable through slots.
      2) Mounting: Hanger inside ductwork.
      3) Length: As indicated on Drawings.
      4) Number of slots, size, location, and throw: See Drawings.
   d. Finish:
      1) Circular diffusers: Clear satin anodized.
      2) Interior of perforated supply and return diffusers: Flat black paint.

K. Volume Dampers and Flow Equalizers for Round Neck Diffusers:

1. Material: Aluminum.
2. Fabrication:
   a. Design for neck velocity: 500 feet/MIN.
   b. Center rod operator accessible through diffuser without removing diffuser.
   c. Furnish with screws, duct collars, transitions and air pattern deflectors as required.

L. Air Grille and Register Assembly:

1. Materials:
   a. Assembly: Extruded aluminum.
   b. Gaskets: Sponge rubber.
2. Fabrication:
   a. Supply registers: Two sets individually adjustable louvers.
   b. Exhaust and return registers: 45 degrees deflection front blades.
   c. Dampers: Key-operated opposed blade.
   d. Screws, duct collars, and transitions as required.
   e. Finish:
      1) Manufacturer's standard factory applied finish.
      2) Color: White.

M. Air Filter Enclosure:

1. Housing:
   a. Factory fabricated.
   b. 16 GA galvanized steel.
   c. Bracing to eliminate racking.

d. Two-side access doors.

2. Access doors:
   a. 16 GA galvanized steel.
   b. Replaceable positive sealing latches.
   c. Replaceable hinges.
   d. Neoprene door gasket.
   e. Holding frame to door gasket: Polyurethane foam.
3. Tracks:
   a. Field adjustable.
   b. Anodized extruded aluminum.
   c. Polypropylene seal between holding frame and track.
4. Holding frame:
   a. Galvanized steel.
   b. Multiple fastener lances.
   c. Polyurethane foam gasket.
      1) Internally.
      2) Frame sides.
   d. Accommodate nominal 24 x 24 inches or 12 x 24 inches filters without modifications to frame or housing.

N. Air Filters:

1. Materials:
   a. Holding frame: Aluminum.
2. Fabrication:
   a. Factory built and assembled unit.
   b. Efficiency rating as per ASHRAE 52.
   c. 2 inches thickness minimum.
   d. Efficiency: 20%.
   e. Air velocity: 450 fpm maximum.
   f. Clean pressure drop: 0.2 inches WG maximum.
   g. Size, capacity, and type: As indicated on Drawings.

O. Temperature Control, Automatic and Manually (Volume) Operated Dampers:

1. Material:
   a. Body: 6063 T5 aluminum.
   b. Seal blade edge: Extruded vinyl.
2. Fabrication:
   a. Frame thickness: 0.125 inches minimum.
   b. Provide flanged connections.
   c. Blades:
      1) Two-position damper: Parallel blade.
      2) Mixing and volume damper: Opposed blade.
      3) Airfoil shape.
      4) Maximum 6 inches width.
   d. Linkage: Concealed in frame.
   e. Axles: 1/2 inches plated steel hex.
   f. Bearings: Molded synthetic.

g. Seals:
    1) Jamb: Flexible compression type.
h. Control shaft: Removable, 1/2 inches diameter.
i. Air leakage (4 feet SQ damper) at 4 inches WG pressure: 99 cfm maximum.
j. Motors for motor operated damper: See Specification Section 23 09 00.
k. Provide outboard support for operator linkage where damper motor is to be installed outside of duct.
l. Provide stainless steel locking quadrants for manual (volume) dampers.
m. Provide fold out operator mounting bracket where damper motor is to be installed on face of damper or inside duct.
n. Finish: 215 R1 anodized.

P. Duct sealer:
1. NFPA rating of "Non-Combustible".
2. Flame spread rating: 25 or lower, in dry condition.
3. Smoke developed rating: 50 or lower, in dry condition.
4. Resistant to water and water vapors.
5. Comply with UL 181.
6. Pressure rupture rating: 16 inches WG, minimum.

Q. Louvers: See Specification Section 08 90 00.

2.3 MAINTENANCE MATERIALS

A. Extra Materials:
1. Furnish Owner with the following extra materials:
a. 1 complete filter media change(s) for each filter unit.
b. Filter media used during construction is in addition to this requirement.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Specification Section 01 65 50.

B. Metal Ductwork:
1. Install with longitudinal seams sealed for zero leakage.
a. For welded seams, submit sample for approval by Engineer.
2. Install gaskets at each transverse joint and fasten sections together with bolts.
a. Tighten for zero leakage.
3. Install supports and hangers with anchors in accordance with SMACNA HVAC Duct Construction Standards.
4. Install turning vanes in square elbows:
a. Unsupported vane length not to exceed 48 inches.
b. Position vanes at proper angle to meet specified pressure drop.
5. Install flexible connections at fans:
a. Locate as close as possible to fan.
b. Allow 1 inch of slack to prevent vibration transmission.
c. Install thrust restraints across connectors.
6. Install access doors where indicated on Drawings and at smoke and fire damper in accordance with NFPA requirements.
7. Volume extractors:

a. Install at supply registers, grilles, diffusers and supply branch connections from ducts.
b. Provide branch duct extensions into main duct above and below extractor when branch duct is narrower than main duct.

C. Flexible Ductwork:

1. Install in concealed areas between: low velocity duct work and diffusers, return air grilles or exhaust outlets and ducts.
2. Use low loss fittings for connection to duct.
3. Connect to metal duct collars by means of non-combustible synthetic rubber sealing compound and stainless steel drawband.
4. Install with maximum length of 3 feet and no change in direction.

D. Drain Pans:

1. Install at fan coil cooling coils, control valves above finished ceilings and at other sources of moisture.
2. Install metal tubing at drain and terminate above floor drain, equipment drain and as shown on Drawings.

E. Dampers:

1. Install where indicated on Drawings of sizes shown.
2. Install fire and smoke dampers in ductwork passing through 1 hour or higher fire-rated construction.
   a. Install in wall and floor openings utilizing steel sleeves, angles and other materials following practices required to provide installation in accordance with local building codes.

F. Diffusers:

1. Install where shown on Drawings of size and capacities scheduled on Drawings.
2. Install painted lay-in type in lay-in ceilings.
3. Install prime painted diffusers in areas where duct work is concealed.
4. Install anodized diffusers in exposed duct work.

G. Air Grille and Register Assemblies:

1. Install where shown on Drawings of size and capacities scheduled on Drawings.
2. Install prime painted grilles and registers in areas where duct work is concealed.
   a. Field paint to match adjacent surface finish.

H. Air Filters:

1. Install where shown on Drawings of size and capacity scheduled on Drawings.
2. Do not operate equipment during construction without filters.

END OF SECTION

SECTION 23 34 00
HVAC - FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heating, ventilating, and cooling equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 23 05 13 - Common Motor Requirements for HVAC and Plumbing Equipment.
2. Section 23 05 93 - HVAC Systems - Balancing and Testing.
3. Section 23 07 00 - Pipe, Duct and Equipment Insulation.
4. Section 23 09 00 - Instrumentation and Control for HVAC Systems.
5. Section 23 31 00 - HVAC - Ductwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Air Movement and Control Association (AMCA).
   a. AMCA Publication 203 "Field Performance Measurement of Fan Systems".
   b. ANSI/AMCA 210 "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating".
2. Air Conditioning and Refrigeration Institute (ARI).
3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
   a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
   b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
   c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
4. Canadian Standards Association (CSA).
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
7. National Roofing Contractors Association (NRCA).
8. Underwriters Laboratories, Inc. (UL):
   a. 507, Standard for Electric Fans.

B. Miscellaneous:

1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.

c. Wiring diagrams.
d. Control diagrams.
e. Manufacturer's catalog cuts and technical data.
f. Corrosion-protection information.
g. Fan curves.
h. Sound data.
i. Vibration isolation.
j. Performance data on all equipment.

2. Certifications:
a. Provide certification of thickness of corrosion-protection coating.
b. Fan systems have been tested in accordance with AMCA Standard 210 or 260, and are licensed to bear the AMCA Certified Ratings Seal.

B. Factory Performance test for any fan having a flow rate greater than 1,000 cfm and/or a total static pressure rating equal to or greater than 1.5 inches WC.

1. Pursuant to AMCA Publication 203 or 210 with no plus tolerances on Power and no minus tolerances on flow or pressure.

C. Contract Closeout Information:

1. Operation and Maintenance Data:
a. Provide Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Vibration isolation assemblies:
a. Mason.
b. Vibration Mounting and Controls Co.
c. Vibro-Acoustics.
2. Corrosion-protective coatings:
a. Heresite and Chemical Co.; "Heresite."
b. Aero-Marine Engineering, Inc.
3. In-line centrifugal fans - tube axial fans:
a. Aerovent.
b. Loren Cook.
c. Greenheck.

2.2 GENERAL

A. All Manufactured Units:

1. Comply with Specification Section 23 05 13.
2. Factory wired and assembled.
3. Use fasteners made of same material as unit.
4. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
a. Type: As per Table 47, Chapter 48, ASHRAE HVAC Applications Handbook.

B. All manufactured units shall be constructed with corrosion-resistant materials or have corrosion-resistant coating.

1. Type:

a. Corrosion-resistant materials:
    1) Aluminum.
    2) Stainless steel.
    3) FRP.

2.3 MANUFACTURED UNITS

A. In-Line Centrifugal Fans - Tube Axial Fans:

1. AMCA certified Class I, II, or III.
2. Non-overloading horsepower capability.
3. Materials:
    a. Wheel, impeller hub and blades: Aluminum or stainless steel.
    b. Housing, innertube and belt well: Aluminum or stainless steel.
    c. Inlet cone: Aluminum or stainless steel.
    d. Driver shaft: Solid stainless steel.
4. Airfoil design blades.
    a. All welded construction.
5. All welded housing, innertube and belt well.
6. Innertube construction:
    a. Isolates bearings and drive from airstream.
    b. Removable end covers.
7. Bearings:
    a. Cast iron pillow blocks.
    b. Concentric bearing locking collar for drive shafts 1 inch and larger.
        1) SKF "ConCentra."
        2) Dodge "D Lock."
    c. Regreaseable.
    d. 200,000 hour average life.
8. Motor:
    a. See Specification Section 23 05 13.
    b. Direct Drive Units:
        1) Keyed hub type.
    c. Adjustable motor base.
9. Flanged inlet and outlet.
10. Accessories:
    a. Weatherproof, louvered motor enclosure for exterior installation.
    b. Internal inlet damper with external control linkage.
    c. Stack hood.
    d. Cam type access door.
    e. Ceramic felt shaft seal.
    f. Extended grease links and fittings.
11. Size and capacity as scheduled on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Specification Section 23 05 13.

B. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

C. Do not operate fans for any purpose until ductwork is clean, filters are in place, bearings lubricated and fan has been test run under observation.

3.2 FIELD QUALITY CONTROL

A. Comply with Specification Section 23 05 93.

3.3 ADJUSTING

A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

SECTION 23 74 36
REFRIGERANT PIPING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Refrigeration piping system.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 23 07 00 - Pipe, Duct and Equipment Insulation.
2. Section 23 80 00 - HVAC - Equipment.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
   a. 15, Safety Code for Mechanical Refrigeration.
2. ASTM International (ASTM):
   a. B280, Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.
3. Federal Specification (FS):
   a. WW-T-799, Tube, Copper, Seamless, Water (For Use With Solder-Flared or Compression-Type Fittings).

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
2. Test reports:
   a. A dated declaration of the test of the refrigerant piping for each system shall be provided.
      1) The dated declaration shall include the information outlined in Article 12.3 of ASHRAE 15.
   b. Test reports of the refrigerant piping leak tests for all refrigerant piping systems installed.
   c. The test reports shall contain the following information:
      1) System refrigerant and high and low side pressure used.
      2) Listing of the necessary repairs made before the refrigerant piping system passed the leak test.
      3) Identification of specific system by referencing specific equipment identification numbers.
      4) Leak testing media used.
      5) Suction and discharge refrigerant gas pressures and temperatures taken after the refrigerant system has been charged.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. Provide Operation and Maintenance Manual submittals.

1.4 WARRANTY

A. The completed refrigerant piping system shall be guaranteed to be sufficiently free from leaks so that the loss of refrigerant for 18 months from the date of final payment shall not exceed 5 percent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Refrigerant piping specialties:
    a. Sporlan.
2. Expansion valves:
    a. Sporlan.
    b. Alcoa.
3. Silver solder - "Easy-Flow 45 inches:
    a. Harman.
4. Moisture indicator - "SEE-ALL":
    a. Sporlan.

2.2 REFRIGERANT PIPING AND FITTINGS

A. Refrigerant Piping:

1. Copper tubing conforming to ASTM B280 and/or FS WW-T-799, dehydrated for refrigerant use, with high-temperature soldered joints and wrought copper (400 psiG) fittings.
    a. For underground use: Type K.
    b. For aboveground use: Type L.

B. Piping Joints:

1. Joints between copper tubing and fittings to be high temperature soldered (melting point not less than 1000 degrees F, but less than that of the metal being joined) with phos-copper alloys.
2. Joints between copper and brass, steel, etc., shall be silver soldered only.
    a. Silver solder to be Handy Harmon "Easy-Flow 45."

C. Precharged Line Sets: Size per manufacturer's recommendations.

D. Field Assembled Units:

1. Size refrigeration lines according to manufacturer's published tables using pressure or temperature drops as follows:
    a. Suction lines: 2 degrees F.
    b. Liquid lines: 1 degree F or 2 psi.
    c. Hot gas lines: 1 degree F or 3.6 psi.
    d. Size discharge and hot gas risers for positive oil return to compressors.

E. Hangers: Provide hangars as necessary.

2.3 REFRIGERANT PIPING SPECIALTIES

A. Refrigerant Dryer:

1. Sporlan material "CATCH-ALL" filter-drier with aluminum molded core:
2. In each liquid line.
3. A three-valve bypass around filter-drier.

4. Install so core can be removed without cutting or breaking any refrigerant line.

B. Moisture Indicator:

1. Show presence of moisture in system by change of color.
2. Install full size in the main liquid line adjacent to the filter-drier.
3. Use Sporlan "SEE-ALL."

C. Strainers:

1. Design to permit removing screen without removing strainer from piping system.
2. Screens not larger than 80 mesh.
3. Strainers on liquid line serving each thermostatic expansion valve and in suction line serving each refrigerant compressor not equipped with integral strainer.

D. Oil Traps: Provide in lines as indicated.

2.4 VALVES

A. All Valves:

1. All bronze.
2. 2 inches and less: Solder ends.
3. 3 inches and over: Four bolt union ends.

B. Shut-Off Valves:

1. Packed type with gas-tight cap seal and hard metal seats and shoulders which permit packing stuffing boxes wide open under pressure; or sealed diaphragm type.
2. Wheel, globe, angle or "T" handle.

C. Check Valves:

1. In liquid lines 5/8 inches and less: Lift check type.
2. In lines 3/4 to 2 inches: Swing check type.
3. In lines 3 inches and over: Wafer type swing check with bronze disc.

D. Expansion Valves:

1. Sized by manufacturer for refrigerant used.
2. Provide one in each circuit with liquid distributor connection immediately after.

E. Vent and Test Valves: Angle cap type with seal and outlet caps.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Precharged Line Sets: Install per manufacturer's recommendations.

B. Field Assembled Lines:

1. Refrigerant piping:
   a. In accordance with Specification Section 40 05 00.
   b. Purge refrigerant piping of all air while connections of refrigerant piping are being made.
      1) Shut-off valves.
      2) Connect tank of dry nitrogen to line on back side of valve.
      3) Introduce dry nitrogen into line as refrigerant piping joints are successively made up from valve to each condenser.
2. Testing:
   a. Refrigerant piping systems: Follow general testing guidelines of ASHRAE 15, except as modified herein.

b. Pressurize the high and low pressure sides of the piping system after completion of the refrigerant piping.
    1) Pressurize at the test pressures specified in ASHRAE 15 for the refrigerant type to be used in the system.
c. Repair any leaks and repeat tests until no further leaks are found and the system passes a static leak test at test pressure for a duration of 24 hours.

3. Cleaning:
    a. Disconnect suction and discharge lines from compressor for clean up after complete system is tested.
    b. Valve or blank off system into three separate systems for purpose of cleanup.
        1) Suction side including cooling coils.
        2) Discharge side including air cooled condenser.
        3) Hot gas reheat side including heating DX coils.
    c. Thoroughly clean each system using pumped refrigerant until system is proven clean to satisfaction of refrigeration compressor serviceman.
    d. Notify Engineer for a visual inspection of both cleaning process and completely cleaned system.
4. Evacuation and Drying:
    a. After tests and cleaning have been completed and system proved tight, charge each circuit with dry clean refrigerant to gas pressure as recommended by the equipment manufacturer.
    b. Evacuate to 100 micron Hg and hold for 72 hours.
        1) Use laboratory type vacuum pump capable of holding absolute pressure of 50 micron Hg.
        2) Check the vacuum with a suitable mercury column gage.
    c. Admit another drying charge of refrigerant and allow 4 to 6 hours to absorb moisture and install dryer cores.
    d. Use second evacuation to remove all refrigerant and moisture.
    e. After second evacuation, charge system with refrigerant.
    f. Charge the system with refrigerant as required after final evacuation.

END OF SECTION

SECTION 23 80 00
HVAC - EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Heating, ventilating, and cooling equipment.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 23 05 13 - Common Motor Requirements for HVAC and Plumbing Equipment.
2. Section 23 05 93 - HVAC Systems - Balancing and Testing.
3. Section 23 07 00 - Pipe, Duct and Equipment Insulation.
4. Section 23 09 00 - Instrumentation and Control for HVAC Systems.
5. Section 23 31 00 - HVAC - Ductwork.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Air Movement and Control Association (AMCA).
2. Air Conditioning and Refrigeration Institute (ARI).
3. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE):
   a. HVAC Applications Handbook, Chapter entitled "Sound and Vibration Control."
   b. 20, Methods of Testing for Rating Remote Mechanical-Draft Air-Cooled Refrigerant Condensers.
   c. 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
4. Canadian Standards Association (CSA).
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
7. National Roofing Contractors Association (NRCA).
8. Underwriters Laboratories, Inc. (UL):
   a. 507, Standard for Electric Fans.

B. Miscellaneous:

1. Gage thickness specified herein shall be manufacturer's standard gage for steel and Brown and Sharpe gage for non-ferrous metals.
2. Corrosion protection of equipment to be as specified herein.

1.3 SUBMITTALS

A. Shop Drawings:

1. Fabrication and/or layout drawings.
2. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
   c. Wiring diagrams.
   d. Control diagrams.

e. Manufacturer's catalog cuts and technical data.
f. Corrosion-protection information.
g. Fan curves.
h. Sound data.
i. Vibration isolation.
j. Control description.
k. Performance data on all equipment.

3. Certifications:
   a. Provide certification of thickness of corrosion-protection coating.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. Provide Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Vibration isolation assemblies:
   a. Mason.
   b. Vibration Mounting and Controls Co.
   c. Vibro-Acoustics.
2. Corrosion-protective coatings:
   a. Heresite and Chemical Co.; "Heresite."
   b. Aero-Marine Engineering, Inc.
   c. Luvata ElectroFin.
3. Cooling coils - direct expansion:
   a. Carrier.
   b. Daikin Applied.
   c. AAON.
   d. Lennox.
4. Heating coil - electric:
   a. Carrier.
   b. Daikin Applied.
   c. AAON.
   d. Lennox.
5. Duct heaters - electric:
   a. Brasch.
   b. Industrial Engineering and Equipment Co.
   c. Indeeco.
6. Unitary split system heat pump:
   a. Carrier.
   b. Lennox.
   c. Bryant.

2.2 GENERAL

A. All Manufactured Units:

1. Comply with Specification Section 23 05 13.
2. Factory wired and assembled.
3. Use fasteners made of same material as unit.
4. Fabricate motor assemblies and unit housings with vibration isolation assemblies:
    a. Type: As per Table 47, Chapter 48, ASHRAE HVAC Applications Handbook.

B. All manufactured units shall be constructed with corrosion-resistant materials or have corrosion-resistant coating.

1. Type:
    a. Corrosion-resistant materials:
        1) Aluminum.
        2) Stainless steel.
        3) FRP.

2.3 MANUFACTURED UNITS

A. Equipment Coils:

1. Cooling coils - direct expansion:
    a. ARI certified.
    b. Material:
        1) Aluminum.
        2) Copper with aluminum fins for use in administration units only.
    c. Fin spacing: Minimum 80 fins per foot.
    d. Minimum standard operating limit: 250 psi.
    e. Size and capacity as scheduled.
2. Heating coil - electric:
    a. ARI certified.
    b. 80% nickel, 20% chromium elements.
    c. Maximum heating density: 35 watts/SQIN.
    d. Built-in thermal protection.
    e. Airflow switch.
    f. Built-in circuit fusing.
    g. Control voltage transformer.
    h. Terminal block.
    i. Magnetic contactor.
    j. Fused disconnect switch.
    k. Step controller as required by instrumentation.
    l. Single point electrical connection.
    m. Size and capacity as scheduled on Drawings.

B. Duct Heaters - Electric:

1. UL listed for zero clearance.
2. Materials:
    a. Frame: Stainless steel.
    b. Heating elements: 80% nickel and 20% chromium.
    c. Element terminals: Stainless steel.
    d. Insulators and bracket bushings: Non-porous ceramic.
    e. Terminal box: Aluminized steel.
3. Heating elements:

a. Coils: See paragraph(s) in Article 2.3, Equipment Coils.

4. Automatic reset thermal cutout.
5. Standard, manually replaceable, thermally operated secondary cutout.
6. Duct mounting: Slip-in.
7. Size and capacity as scheduled on Drawings.

C. Unitary Split System Heat Pump:

1. Outdoor Unit:
   a. Casing and frame:
      1) Material: Heavy gage galvanized steel, factory painted.
      2) Insulation: 1 inch thick neoprene-coated glass fiber.
      3) Installation: Base equipped with lifting brackets with lifting holes.
      4) Removable end panel for access to components and connections.
   b. Compressors:
      1) Modulating Scroll type, with five-year non-prorated warranty.
      2) Suction and discharge service valves.
      3) Crankcase heater.
      4) Thermal overload protection.
   c. Refrigeration circuit:
      1) Sight glass.
      2) Filter dryer.
      3) Manual shut-off valve.
      4) High pressure relief valve.
   d. Compressor isolators.
   e. Condenser coils:
      1) Nominal 3/8 inches OD seamless copper mechanically bonded to corrugated aluminum fins.
      2) Factory leak tested at 315 psiG under water.
   f. Condenser fans:
      1) Direct drive: See Specification Section 23 05 13.
      2) Propeller type.
   g. Condenser fan motors:
      1) Heavy duty, inherently protected, non-reversing.
      2) Permanently lubricated bearings.
      3) Integral rain shield.
   h. Defrost control: Defrost cycles at a preselected time interval when the outdoor coil is below a preset initiation temperature.
   i. Expansion valve: Designed and sized specifically for heat pump service.
   j. Reversing valve: Four-way interchange reversing valve, operates on pressure differential between the outdoor unit and indoor unit.
2. Indoor unit:
   a. Materials:
      1) Casing: Heavy gage steel.
      2) Framework: Steel angle.
      3) Pan insulation: Foam-in-place insulation.
      4) Casing insulation: 1 inch, 3/4 pound fiberglass blanket.
   b. Casing:

1) Sectionalized construction.
2) Removable access panels.
3) Insulated weatherproof casing.

c. Evaporated fans:
1) Double-width, double-inlet centrifugal type.
2) Forward curved or airfoil.
3) Solid steel shafts.
4) 200,000 hour relubricative ball-bearings.

d. Fan motors:
1) See Specification Section 23 05 13.
2) Relubricative ball-bearings.
3) Variable pitch sheave.
4) Adjustable base.

e. V-belts and drives sized for 150% motor capacity.

f. Isolated fan assembly.

g. Filter section:
1) Filters: See Specification Section 23 31 00.
2) Access doors for filter removal.

h. Evaporator coils: See paragraph(s) in Article 2.3, Equipment Coils.

i. Evaporator coil circuiting:
1) Adjustable thermal expansion valve per circuit with external equalizer.
2) Combination row/split face circuiting.

j. Drain pan:
1) Mastic-coated.
2) Threaded drain connections.

k. Electric heating coil: See paragraph(s) in Article 2.3, Equipment Coils.
1) Built-in static-pressure airflow switch.

l. Size and capacity as scheduled on Drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with Specification Section 23 05 13.

B. Install fixed pitched drive sheave after sheave has been sized based on accepted test and balance report.

3.2 FIELD QUALITY CONTROL

A. Comply with Specification Section 23 05 93.

3.3 ADJUSTING

A. Install new filters on units which have been running prior to acceptance of Project.

END OF SECTION

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SECTION 23 83 00
RADIANT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Radiant heaters.

B. Related Sections include but are not necessarily limited to:

1. Section 23 05 93 - HVAC Systems - Balancing and Testing.
2. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
3. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Gas Association (AGA).
2. Local Gas Company Regulations.
3. National Fuel Gas Code.
4. Underwriters Laboratories, Inc. (UL).

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Manufacturer's installation instructions.
2. Fabrication and/or layout drawings:
   a. System layout drawings showing connection, burner, and ancillary equipment details.
3. Test reports:
   a. Factory tested prior to shipment.
   b. Field tested after installation.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. Provide Operation and Maintenance Manual submittals.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Electric ceiling panels radiant heaters:
   a. Base:
      1) AZTEC.
      2) Emerson.
      3) Indeeco.

2.2 ELECTRIC CEILING PANEL RADIANT HEATERS

A. Provide electric units with backbox, insulation, heating element, radiant face and mounting configuration.

B. Housing: Galvanized steel housings shall be 24 GA back and 22 GA front with sides formed by overlapping back and front panels and fastened together.

C. Frame, for surface and recessed mounting:

1. Galvanized steel.
2. Aluminum.
3. Wood.
4. Frame type as indicated on drawings.
5. T-bar frames by ceiling work.

D. Element: Graphite based with uniform temperature distribution over entire panel surface.

E. Insulation: 1 inch thick, 1 pound density high temperature fiberglass.

F. Surface: Front panel shall be coated using a product as recommended by manufacturer.

G. Wire:

1. Internal wiring shall be 200 degrees C rated, 14 GA with Teflon insulation.
2. External wiring shall be 14 GA in 40 inches long flexible conduit and J-box connector.

H. Voltage: 240 and single phase.

I. Thermostats:

1. Single stage heating type with subbase for on-auto-off switch.
2. Mount thermostats as indicated.
3. Provide control wiring and conduit.
4. Control voltage: 24 V.
5. For low voltage control systems, 24 V, provide Contractors near panels.

PART 3 - EXECUTION

3.1 GENERAL

A. Install radiant panel system as recommended by manufacturer and as specified.

B. Install units plumb and level.

1. Where units are to be installed at an angle they shall be installed uniform.

C. Maintain heater clearances to combustibles as shown on manufacturer's installation instructions.

D. Piping and electrical connections shall be flexible connectors.

E. Provide control wiring in conduit in compliance with Specification Section 26 05 19 - Wire and Cable - 600 Volt and Below and Specification Section 26 05 33 - Raceways and Boxes.

F. Verify electrical voltages required by heaters and provide transformers as necessary.

G. Mounting shall be rigid brackets type and shall conform to manufacturers mounting instructions.

H. Electrical work shall install power and control wiring as shown on electrical drawings.

1. Work not shown on electrical drawings shall be provided by mechanical work.

3.2 ELECTRIC CEILING PANEL RADIANT HEATERS

A. Verify installation for T-Bar, recessed or surface mounting.

B. T-Bar panels shall match ceiling tile as close as possible.

C. For color units, colors shall be selected by Architect.

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DIVISION 26

ELECTRICAL

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SECTION 26 05 00
ELECTRICAL - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Basic requirements for electrical systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 03 - Concrete.
2. Section 03 15 19 - Anchorage to Concrete.
3. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
4. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA):
   a. ADM, Aluminum Design Manual.
2. American Institute of Steel Construction (AISC):
   a. Steel Construction Manual.
3. American National Standards Institute (ANSI).
4. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   c. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C2, National Electrical Safety Code (NESC).
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
7. National Electrical Manufacturers Association (NEMA):
8. Underwriters Laboratories, Inc. (UL).

B. Products to be listed by a Nationally Recognized Testing Laboratory (NRTL) in accordance with applicable product standards.

1. Applicable product standards including, but not limited to, ANSI, FM, IEEE, NEMA and UL.
2. NRTL includes, but is not limited to, CSA Group Testing and Certification (CS), FM Approvals LLC (FM), Intertek Testing Services NA, Inc. (ETL), and Underwriters Laboratories, Inc. (UL).

1.3 DEFINITIONS

A. For the purposes of providing materials and installing electrical work the following definitions shall be used.

1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.

2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors, and other similar occupied spaces.
3. Non-architecturally finished interior area: Pump, chemical, mechanical, electrical rooms and other similar process type rooms.
4. Hazardous areas: Class I, II or III areas as defined in NFPA 70.
5. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 61 03 and individual specification sections for submittal requirements for products defined as equipment.
2. General requirements:
   a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
   b. Include data sheets that include manufacturer's name and product model number.
      1) Clearly identify all optional accessories.
   c. Acknowledgement that products are NRTL listed or are constructed utilizing NRTL recognized components.
   d. Manufacturer's delivery, storage, handling and installation instructions.
   e. Product installation details.
   f. Short Circuit Current Rating (SCCR) nameplate marking per NFPA 70, include any required calculations.
   g. See individual specification sections for any additional requirements.
3. Fabrication and/or layout drawings:
   a. Concrete and reinforcing steel, per Division 03 requirements.

B. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 33 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.

1. Outdoor areas:
   a. Wet.
   b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
2. Indoor areas:
   a. Dry.
   b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.

B. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

A. Electrical Equipment Support Pedestals and/or Racks:

1. Manufacturers:
   a. Modular strut:
      1) Unistrut Building Systems.
      2) B-Line by Eaton.
      3) Globe Strut.
      4) Superstrut by Thomas & Betts.
2. Material requirements:
   a. Modular strut:
      1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
      2) Stainless steel: AISI Type 316.
      3) PVC coated galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.
      4) Aluminum: AA Type 6063-T6.
   b. Structural members (e.g., I beams, L and C channels):
      1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
      2) Aluminum: AA Type 6061-T6 or 6063-T6.
   c. Mounting plates:
      1) Galvanized steel: ASTM A36/A36M steel with galvanizing per ASTM A123/A123M.
      2) Aluminum: AA Type 6063-T6.
   d. Mounting hardware:
      1) Galvanized steel.
      2) Stainless steel.
   e. Anchorage per Specification Section 03 15 19.
   f. Concrete and reinforcing steel: See Division 03 specifications.

B. Equipment pads (interior and exterior):

1. Concrete and reinforcing steel: See Division 03 specifications.

C. Field touch-up of galvanized surfaces.

1. Zinc-rich primer.
   a. One coat, 3.0 mils, ZRC by ZRC Products.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

B. Install equipment in accordance with the requirements of:

1. NFPA 70.
2. IEEE C2.
3. The manufacturer's instructions.

C. In general, conduit routing is not shown on the Drawings.

1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.

D. When complete branch circuiting is not shown on the Drawings:

1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.

E. Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.

F. Install equipment plumb, square and true with construction features and securely fastened.

G. Install electrical equipment, including pull and junction boxes, minimum of 6 inches from process, gas, air and water piping and equipment.

H. Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.

I. Device Mounting Schedule:

1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
   a. Light switch (to center): 46 inches.
   b. Receptacle in architecturally finished areas (to center): 18 inches.
   c. Receptacle on exterior wall of building (to center): 18 inches.
   d. Receptacle in non-architecturally finished areas (to center): 46 inches.
   e. Telephone outlet in architecturally finished areas (to center): 18 inches.
   f. Telephone outlet for wall-mounted phone (to center): 46 inches.
   g. Safety switch (to center of operating handle): 54 inches.
   h. Separately mounted motor starter (to center of operating handle): 54 inches.
   i. Pushbutton or selector switch control station (to center): 46 inches.
   j. Panelboard (to top): 72 inches.

J. Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.

1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make adjustments of up to 6 inches in equipment location with the Engineer's approval.

K. Provide electrical equipment support system per the following area designations:

1. Dry areas:
   a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
   b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
2. Wet areas:

a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.

3. Corrosive areas:
   a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts and hardware.
4. Highly corrosive areas:
   a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.

L. Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.

1. See Specification Section 03 15 19.
2. Do not cut, or weld to, building structural members.
3. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

M. Provide non-metallic corrosion resistant spacers to maintain 1/4 inches separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.

N. Do not place equipment fabricated from aluminum in direct contact with earth or concrete.

O. Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.

P. Do not use materials that may cause the walls or roof of a building to discolor or rust.

Q. Identify electrical equipment and components in accordance with Specification Section 10 14 00.

R. Provide field markings and/or documentation of available short-circuit current (available fault current) and related information for equipment as required by the NFPA 70 and other applicable codes.

S. Provide equipment or control panels with Short Circuit Current Rating (SCCR) labeling as required by NFPA 70 and other applicable codes.

1. Determine the SCCR rating by one of the following methods:
   a. Method 1: SCCR rating meets or exceeds the available fault current of the source equipment when indicated on the Drawings.
   b. Method 2: SCCR rating meets or exceeds the source equipment's Amp Interrupting Current (AIC) rating as indicated on the Drawings.
   c. Method 3: SCCR rating meets or exceeds the calculated available short circuit current at the control panel.
2. The source equipment is the switchboard, panelboard, motor control center or similar equipment where the equipment or control panel circuit originates.
3. For Method 3, provide calculations justifying the SCCR rating. Utilize source equipment available fault current or AIC rating as indicated on the Drawings.

3.2 FIELD QUALITY CONTROL

A. Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.

B. Replace equipment and systems found inoperative or defective and re-test.

C. The protective coating integrity of support structures and equipment enclosures shall be maintained.

1. Repair galvanized components utilizing a zinc rich paint.
2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
4. Repair surfaces which will be inaccessible after installation prior to installation.
5. See Specification Section 26 05 33 for requirements for conduits and associated accessories.

D. Replace nameplates damaged during installation.

SECTION 26 05 19

WIRE AND CABLE - 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
    a. Building wire.
    b. Power cable.
    c. Control cable.
    d. Instrumentation cable.
    e. Wire connectors.
    f. Insulating tape.
    g. Pulling lubricant.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Insulated Cable Engineers Association (ICEA):
    a. S-58-679, Standard for Control Cable Conductor Identification.
2. National Electrical Manufacturers Association (NEMA):
    a. ICS 4, Industrial Control and Systems: Terminal Blocks.
3. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
    a. WC 57/S-73-532, Standard for Control Cables.
    b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
4. National Fire Protection Association (NFPA):
    a. 70, National Electrical Code (NEC).
    b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
5. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
    a. 568, Commercial Building Telecommunications Cabling Standard.
6. Underwriters Laboratories, Inc. (UL):
    a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
    b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
    c. 467, Standard for Safety Grounding and Bonding Equipment.
    d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
    e. 486C, Standard for Safety Splicing Wire Connections.
    f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
    g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.

h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.

i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

A. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

B. Instrumentation Cable:

1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.
2. The following are specific types of instrumentation cables:
   a. Analog signal cable:
      1) Used for the transmission of low current (e.g., 4-20mA DC) or low voltage (e.g., 0-10 VDC) signals, using No. 16 AWG and smaller conductors.
      2) Commonly used types are defined in the following:
         a) TSP: Twisted shielded pair.
         b) TST: Twisted shielded triad.
   b. Digital signal cable: Used for the transmission of digital signals between computers, PLC's, RTU's, etc.

C. Control Cable: Multi-conductor, insulated, with outer sheath containing building wires, No. 14, No. 12 or No. 10 AWG.

D. Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
      1) Wire connectors.
      2) Insulating tape.
      3) Cable lubricant.
   b. See Specification Section 26 05 00 for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Building wire, power and control cable:
   a. Aetna Insulated Wire.
   b. Alphawire.
   c. Cerrowire.
   d. Encore Wire Corporation.
   e. General Cable.
   f. Okonite Company.
   g. Southwire Company.
2. Instrumentation cable:

a. Analog cable:
    1) Alphawire.
    2) Belden Inc.
    3) General Cable.
3. Wire connectors:
    a. Burndy Corporation.
    b. Buchanan.
    c. Ideal.
    d. Ilsco.
    e. 3M Co.
    f. Teledyne Penn Union.
    g. Thomas and Betts.
    h. Phoenix Contact.
4. Insulating and color coding tape:
    a. 3M Co.
    b. Plymouth Bishop Tapes.
    c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

A. Building Wire:

1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.
5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Control Cable:

1. Conductor shall be copper with 600 V rated insulation.
2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
3. Conform to NEMA/ICEA WC 57/S-73-532 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
4. Conform to NEMA/ICEA WC 57/S-73-532 and UL 44 and UL 1277 for type XHHW-2 insulation with an overall PVC jacket.
5. Number of conductors as required, provided with or without bare ground conductor of the same AWG size.
    a. When a bare ground conductor is not provided, an additional insulated conductor shall be provided and used as the ground conductor (e.g., 6/c No. 14 w/g and 7/c No. 14 are equal).
6. Individual conductor color coding:
    a. ICEA S-58-679, Method 1, Table E-2.
    b. See PART 3 of this Specification Section for additional requirements.

C. Electrical Equipment Control Wire:

1. Conductor shall be copper with 600 V rated insulation.
2. Conductors shall be stranded.

3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
4. Conform to UL 44 for Type SIS insulation.
5. Conform to UL 83 for Type MTW insulation.

D. Instrumentation Cable:

1. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
2. Analog cable:
   a. Tinned copper conductors.
   b. 300 V or 600 V PVC insulation with PVC jacket.
   c. Twisted with 100% foil shield coverage with drain wire.
   d. Six (6) twists per foot minimum.
   e. Individual conductor color coding: ICEA S-58-679, Method 1, Table E-2.
   f. Conform to [IEEE 1202 or CSA FT-4 or NFPA 262,] UL 2250, UL 1581 and NFPA 70 Type ITC.
3. Digital cable:
   a. As recommended by equipment (e.g., PLC, RTU) manufacturer.
   b. Horizontal voice and data cable:
      1) Category 6 per TIA/EIA/ANSI 568.
      2) Cable shall be label-verified.
      3) Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
      4) Conductors: No. 24 AWG solid untinned copper.
      5) Rated CMP per NFPA 70.
   c. Conform to NFPA 262 and NFPA 70 Type ITC.

E. Wire Connectors:

1. Twist/screw on type:
   a. Insulated pressure or spring type solderless connector.
   b. 600 V rated.
   c. Ground conductors: Conform to UL 486C and/or UL 467 when required by local codes.
   d. Phase and neutral conductors: Conform to UL 486C.
2. Compression and mechanical screw type:
   a. 600 V rated.
   b. Ground conductors: Conform to UL 467.
   c. Phase and neutral conductors: Conform to UL 486A.
3. Terminal block type:
   a. High density, screw-post barrier-type with white center marker strip.
   b. 600 V and ampere rating as required, for power circuits.
   c. 600 V, 20 ampere rated for control circuits.
   d. 300 V, 15 ampere rated for instrumentation circuits.
   e. Conform to NEMA ICS 4 and UL 486A.

F. Insulating and Color Coding Tape:

1. Pressure sensitive vinyl.
2. Premium grade.
3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.

5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
   a. Insulating tape: Black.
   b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

G. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:

1. Type XHHW-2:
   a. Building wire and power and control cable in architectural and non-architectural finished areas.
   b. Building wire and power and control cable in conduit in outdoor areas and below grade.
   c. Building wire and power and control cable in cable tray in outdoor areas.
2. Type THHN/THWN and THHN/THWN-2:
   a. Building wire and power and control cable No. 8 AWG and smaller in architectural and non-architectural finished areas.
3. Type SIS and MTW:
   a. For the wiring of control equipment within control panels and field wiring of control equipment within switchgear, switchboards, motor control centers.

B. Conductor Size Limitations:

1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

C. Color Code All Wiring as Follows:

1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

* Orange when it is a high leg of a 120/240 V Delta system.

   a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
   b. Conductors larger than No. 6 AWG:
      1) Insulated phase and neutral conductors shall be identified by one of the following methods:
         a) Continuous colored outer finish along its entire length.

b) 3 inches of colored tape applied at the termination.

2) Insulated grounding conductor shall be identified by one of the following methods:

a) Continuous green outer finish along its entire length.

b) Stripping the insulation from the entire exposed length.

c) Using green tape to cover the entire exposed length.

3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.

2. Power cables ICEA S-58-679, Method 4 with:

a. Phase and neutral conductors identified with 3 inches of colored tape, per the Table herein, applied at the terminations.

b. Ground conductor: Bare.

3. Control cables ICEA S-58-679, Method 1, Table E-2:

a. When a bare ground is not provided, one of the colored insulated conductors shall be re-identified by stripping the insulation from the entire exposed length or using green tape to cover the entire exposed length.

b. When used in power applications the colored insulated conductors used as phase and neutral conductors may have to be re-identified with 3 inches of colored tape, per the Table herein, applied at the terminations.

D. Install all wiring in raceway unless otherwise indicated on the Drawings.

E. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:

1. Where specifically indicated on the Drawings.

2. Where field conditions dictate and written permission is obtained from the Engineer.

3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.

a. The combinations shall comply with the following:

1) 12 VDC, 24 VDC and 48 VDC may be combined.

2) 125 VDC shall be isolated from all other AC and DC circuits.

3) AC control circuits shall be isolated from all DC circuits.

4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.

a. The combinations shall comply with the following:

1) Analog signal circuits may be combined.

2) Digital signal circuits may be combined but isolated from analog signal circuits.

5. Multiple branch circuits for similar loads may be combined in a common raceway, such as multiple lighting circuits or multiple receptacle circuits or other 120Vac circuits. Do not combine lighting and receptacle circuits.

a. Do not combine control device circuits with lighting or receptacle circuits.

b. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:

1) Up sizing conductor size for required ampacity de-ratings for the number of current carrying conductors in the raceway.

2) The neutral conductors may not be shared.

3) Up sizing raceway size for the size and quantity of conductors.

F. Ground the drain wire of shielded instrumentation cables at one end only.

1. The preferred grounding location is at the load (e.g., control panel), not at the source (e.g., field mounted instrument).

G. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.

1. Feeder and branch power circuits:
    a. Device outlet boxes:
        1) Twist/screw on type connectors.
    b. Junction and pull boxes and wireways:
        1) Twist/screw on type connectors for use on No. 8 and smaller wire.
        2) Compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 6 AWG and larger wire.
    c. Motor terminal boxes:
        1) Twist/screw on type connectors for use on No. 10 AWG and smaller wire.
        2) Insulated mechanical screw type connectors for use on No. 8 AWG and larger wire.
    d. Manholes or handholes:
        1) Twist/screw on type connectors pre-filled with epoxy for use on No. 8 AWG and smaller wire.
        2) Watertight compression or mechanical screw type connectors for use on No. 6 AWG and larger wire.
2. Control circuits:
    a. Junction and pull boxes: Terminal block type connector.
    b. Manholes or handholes: Twist/screw on type connectors pre-filled with epoxy.
    c. Control panels and motor control centers: Terminal block or strips provided within the equipment or field installed within the equipment by the Contractor.
3. Instrumentation circuits can be spliced where field conditions dictate and written permission is obtained from the Engineer.
    a. Maintain electrical continuity of the shield when splicing twisted shielded conductors.
    b. Junction and pull boxes: Terminal block type connector.
    c. Control panels and motor control centers: Terminal block or strip provided within the equipment or field installed within the equipment by the Contractor.
4. Non-insulated compression and mechanical screw type connectors shall be insulated with tape or hot or cold shrink type insulation to the insulation level of the conductors.

H. Insulating Tape Usage:

1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.

I. Color Coding Tape Usage: For color coding of conductors.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing:

1. See Specification Section 26 08 13.

END OF SECTION

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SECTION 26 05 26
GROUNDING AND BONDING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for grounding and bonding system(s).

B. Related Specification Sections include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.
2. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
3. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.
3. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
4. Underwriters Laboratories, Inc. (UL):
   a. 467, Grounding and Bonding Equipment.

B. Assure ground continuity is continuous throughout the entire Project.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data.
   a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
      1) Grounding clamps, terminals and connectors.
      2) Exothermic welding system.
   b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Ground rods and bars and grounding clamps, connectors and terminals:
   a. ERICO by Pentair.
   b. Harger Lightning & Grounding.
   c. Heary Bros. Lightning Protection Co. Inc..
   d. Burndy by Hubbell.
   e. Robbins Lightning, Inc.
   f. Blackburn by Thomas & Betts.

g. Thompson Lightning Protection, Inc.

2. Exothermic weld connections:
   a. ERICO by Pentair - Cadweld.
   b. Harger Lightning & Grounding - Ultraweld.
   c. Burndy by Hubbell - Thermoweld.
   d. FurseWELD by Thomas & Betts.

2.2 COMPONENTS

A. Wire and Cable:

1. Bare conductors: Soft drawn stranded copper meeting ASTM B8.
2. Insulated conductors: Color coded green, per Specification Section 26 05 19.

B. Conduit: As specified in Specification Section 26 05 33.

C. Ground Bars:

1. Solid copper:
   a. 1/4 inches thick.
   b. 2 or 4 inches wide.
   c. 12 inches long .
2. Predrilled grounding lug mounting holes.
3. Stainless steel or galvanized steel mounting brackets.
4. Insulated standoffs.

D. Ground Rods:

1. 5/8 inches x 10 feet.
2. Copper-clad:
   a. 10 mil minimum uniform coating of electrolytic copper molecularly bonded to a rigid steel core.
   b. Corrosion resistant bond between the copper and steel.
   c. Hard drawn for a scar-resistant surface.

E. Grounding Clamps, Connectors and Terminals:

1. Mechanical type:
   a. Standards: UL 467.
   b. High copper alloy content.
2. Compression type for interior locations:
   a. Standards: UL 467.
   b. High copper alloy content.
   c. Non-reversible.
   d. Terminals for connection to bus bars shall have two bolt holes.
3. Compression type suitable for direct burial in earth or concrete:
   a. Standards: UL 467, IEEE 837.
   b. High copper alloy content.
   c. Non-reversible.
   d. Factory filled with oxide inhibiting compound.

F. Exothermic Weld Connections:

1. Copper oxide reduction by aluminum process.
2. Molds properly sized for each application.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions.
2. Size grounding conductors and bonding jumpers in accordance with NFPA 70, Article 250, except where larger sizes are indicated on the Drawings.
3. Remove paint, rust, or other non-conducting material from contact surfaces before making ground connections. After connection, apply manufacturers approved touch-up paint to protect metallic surface from corrosion.
4. Where ground conductors pass through floor slabs or building walls provide nonmetallic sleeves and install sleeve.
    a. Seal the sleeve interior to stop water penetration.
5. Do not splice grounding electrode conductors except at ground rods.
6. Install ground rods and grounding electrode conductors in undisturbed, firm soil.
    a. Provide excavation required for installation of ground rods and conductors.
    b. Use driving studs or other suitable means to prevent damage to threaded ends of sectional rods.
    c. Unless otherwise specified, connect conductors to ground rods with compression type connectors or exothermic weld.
    d. Provide sufficient slack in conductor to prevent conductor breakage during backfill or due to ground movement.
    e. Backfill excavation completely, thoroughly tamping to provide good contact between backfill materials and ground rods and conductors.
7. Do not use exothermic welding if it will damage the structure the grounding conductor is being welded to.

B. Grounding Electrode System:

1. Provide a grounding electrode system in accordance with NFPA 70, Article 250 and as indicated on the Drawings.
    a. All grounding electrode conductors terminate on a main ground bar located adjacent to the service entrance equipment.
2. Grounding electrode conductor terminations:
    a. Ground bars mounted on wall: Use a two-hole compression type conductor terminal and bolt it to the ground bar with two bolts.
    b. Ground bars in electrical equipment: Use compression type conductor terminal and bolt it to the ground bar or manufacture's provided mechanical type termination device.
    c. Piping systems: Use mechanical type connections.
    d. Building steel, below grade and encased in concrete: Use compression type connector or exothermic weld.
    e. Building steel, above grade: Use a two-hole compression type conductor terminal and bolt to the steel with two bolts or exothermic weld.
    f. Ground rod: Compression type or exothermic weld, unless otherwise specified.
3. Triad grounding system:
    a. Triad consists of three ground rods arranged in a triangle separated by 20 feet and a conductor interconnecting each ground rod.
    b. Place first ground rod a minimum of 10 feet from the structure foundation and 2 FT-6 IN below grade.
    c. Grounding conductor: Bare conductor, size as indicated on the Drawings.
4. Ufer grounding system:

a. Ufer consists of ground rods placed 10 feet from foundation and a conductor looped in the structure foundation.
b. Place ground rods 2 feet-6 inches below grade.
c. Bond conductor to rebar every 50 feet.
d. Provide ground rods connected to the conductor at all 90 degrees corners in the foundation and at additional location so that the maximum distance between ground rods does not exceed 50 feet.
e. Grounding conductor: Bare conductor, size as indicated on the Drawings.

C. Supplemental Grounding Electrode:

1. Provide the following grounding in addition to the equipment ground conductor supplied with the feeder conductors whether or not shown on the Drawings.
   a. See Grounding Electrode System paragraph for conductor termination requirements.

D. Raceway Bonding/Grounding:

1. Install all metallic raceway so that it is electrically continuous.
2. Provide an equipment grounding conductor in all raceways with insulation identical to the phase conductors, unless otherwise indicated on the Drawings.
3. NFPA 70 required grounding bushings shall be of the insulating type.
4. Provide double locknuts at all panels.
5. Bond all conduits, at entrance and exit of equipment, to the equipment ground bus or lug.
6. Provide bonding jumpers if conduits are installed in concentric knockouts.
7. Make all metallic raceway fittings and grounding clamps tight to ensure equipment grounding system will operate continuously at ground potential to provide low impedance current path for proper operation of overcurrent devices during possible ground fault conditions.

E. Equipment Grounding:

1. Ground all utilization equipment with an equipment grounding conductor.

3.2 FIELD QUALITY CONTROL

A. Leave grounding system uncovered until observed by Owner.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
    a. Conduits.
    b. Conduit fittings.
    c. Conduit supports.
    d. Wireways.
    e. Outlet boxes.
    f. Pull and junction boxes.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.
2. Section 26 27 26 - Wiring Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Aluminum Association (AA).
2. American Iron and Steel Institute (AISI).
3. ASTM International (ASTM):
    a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
    b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
    c. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
4. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
    c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
    d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
    e. TC 14.AG, Aboveground Reinforced Thermosetting Resin Conduit and Fittings.
    f. TC 14.BG, Belowground Reinforced Thermosetting Resin Conduit and Fittings.
5. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
    a. C80.1, Electric Rigid Steel Conduit (ERSC).
    b. C80.3, Steel Electrical Metallic Tubing (EMT).
    c. C80.5, Electrical Aluminum Rigid Conduit (ERAC).
    d. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
6. National Fire Protection Association (NFPA):
    a. 70, National Electrical Code (NEC).
7. Underwriters Laboratories, Inc. (UL):
    a. 1, Standard for Flexible Metal Conduit.

b. 6, Electrical Rigid Metal Conduit - Steel.
c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
d. 360, Standard for Liquid-Tight Flexible Metal Conduit.
e. 467, Grounding and Bonding Equipment.
f. 514A, Metallic Outlet Boxes.
g. 514B, Conduit, Tubing, and Cable Fittings.
h. 651, Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
i. 797, Electrical Metallic Tubing - Steel.
j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.
k. 1203, Standard for Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations.
l. 2420, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
m. 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

A. Shop Drawings:
1. Product technical data:
a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
1) Conduit fittings.
2) Support systems.
b. See Specification Section 26 05 00 for additional requirements.
2. Fabrication and/or layout drawings:
a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Rigid metal conduits and electrical metallic tubing:
a. Allied Tube and Conduit.
b. Western Tube and Conduit Corporation.
c. Wheatland Tube.
d. Patriot Aluminum Products, LLC.
2. PVC coated rigid metal conduits:
a. Robroy Industries.
b. Atkore - Calbond
3. Rigid nonmetallic conduit:
a. Prime Conduit.
b. Cantex, Inc.
c. Osburn Associates, Inc.
d. Champion Fiberglass, Inc.
e. United Fiberglass of America, Inc.
4. Flexible conduit:

a. AFC Cable Systems.
b. Anamet, Inc.
c. Electri-Flex Company.
d. International Metal Hose Company.
e. Southwire Company, LLC.

5. Wireway:
   a. Hoffman Engineering.
   b. Wiegmann by Hubbell.
   c. Square D by Schneider Electric.
6. Conduit fittings and accessories:
   a. Appleton by Emerson Electric Co.
   b. Carlon by Thomas & Betts.
   c. Cantex, Inc.
   d. Crouse-Hinds by Eaton.
   e. Killark by Hubbell.
   f. Osburn Associates, Inc.
   g. O-Z/Gedney by Emerson Electric Co.
   h. Raco by Hubbell.
   i. Steel City by Thomas & Betts.
   j. Thomas & Betts.
7. Support systems:
   a. Unistrut by Atkore International, Inc.
   b. B-Line by Eaton.
   c. Kindorf by Thomas & Betts.
   d. Minerallac Company.
   e. CADDY by Pentair.
   f. Superstrut by Thomas & Betts.
8. Outlet, pull and junction boxes:
   a. Appleton by Emerson Electric Co.
   b. Crouse-Hinds by Eaton
   c. Killark by Hubbell.
   d. O-Z/Gedney by Emerson Electric Co.
   e. Steel City by Thomas & Betts.
   f. Raco by Hubbell
   g. Bell by Hubbell.
   h. Hoffman Engineering.
   i. Wiegmann by Hubbell.
   j. B-Line by Eaton.
   k. Adalet.
   l. RITTAL North America LLC.
   m. Stahlin by Robroy Enclosures.

2.2 RIGID METAL CONDUITS

A. Rigid Galvanized Steel Conduit (RGS):

1. Mild steel with continuous welded seam.
2. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.

3. Threads galvanized after cutting.
4. Internal coating: Baked lacquer, varnish or enamel for a smooth surface.
5. Standards: NFPA 70 Type RMC, NEMA/ANSI C80.1, UL 6.

2.3 ELECTRICAL METALLIC TUBING (EMT)

A. Mild steel with continuous welded seam.

B. Metallic zinc applied by hot-dip galvanizing or electro-galvanizing.

C. Internal coating: Baked lacquer, varnish, or enamel for a smooth surface.

D. Standards: NFPA 70 Type EMT, NEMA/ANSI C80.3, UL 797.

2.4 RIGID NONMETALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):

1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
2. Rated for direct sunlight exposure.
3. Fire retardant and low smoke emission.
4. Shall be suitable for use with 90 degrees C wire and shall be marked "maximum 90 degrees C".
5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.

2.5 FLEXIBLE CONDUIT

A. Flexible Galvanized Steel Conduit (FLEX):

1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Standard: NFPA 70 Type FMC, UL 1.

B. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):

1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Extruded PVC outer jacket positively locked to the steel core.
3. Liquid and vaportight.
4. Standard: NFPA 70 Type LFMC, UL 360.

2.6 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with RGS:

1. General:
   a. In hazardous locations listed for use in Class I, Groups C and D locations.
2. Locknuts:
   a. Threaded steel or malleable iron.
   b. Gasketed or non-gasketed.
   c. Grounding or non-grounding type.
3. Bushings:
   a. Threaded, insulated metallic.
   b. Grounding or non-grounding type.
4. Hubs: Threaded, insulated and gasketed metallic for raintight connection.
5. Couplings:
   a. Threaded straight type: Same material and finish as the conduit with which they are used on.
   b. Threadless type: Gland compression or self-threading type, concrete tight.

6. Unions: Threaded galvanized steel or zinc plated malleable iron.
7. Conduit bodies (ells and tees):
    a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
    b. Standard and mogul size.
    c. Cover:
        1) Clip-on type with stainless steel screws.
        2) Gasketed or non-gasketed galvanized steel, zinc plated cast iron or cast copper free aluminum.
8. Conduit bodies (round):
    a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
    b. Cover: Threaded screw on type, gasketed, galvanized steel, zinc plated cast iron or cast copper free aluminum.
9. Sealing fittings:
    a. Body: Zinc plated cast iron or cast copper free aluminum with threaded hubs.
    b. Standard and mogul size.
    c. With or without drain and breather.
    d. Fiber and sealing compound: UL listed for use with the sealing fitting.
10. Expansion couplings:
    a. 2 inches nominal straight-line conduit movement in either direction.
    b. Galvanized steel with insulated bushing.
    c. Gasketed for wet locations.
    d. Internally or externally grounded.
11. Expansion/deflection couplings:
    a. 3/4 inches nominal straight-line conduit movement in either direction.
    b. 30 degrees nominal deflection from the normal in all directions.
    c. Metallic hubs, neoprene outer jacket and stainless steel jacket clamps.
    d. Internally or externally grounded.
    e. Watertight, raintight and concrete tight.
12. Standards: UL 467, UL 514B, UL 1203.

B. Fittings for Use with EMT:
1. Connectors:
    a. Straight, angle and offset types furnished with locknuts.
    b. Zinc plated steel.
    c. Insulated gland compression type.
    d. Concrete and raintight.
2. Couplings:
    a. Zinc plated steel.
    b. Gland compression type.
    c. Concrete and raintight.
3. Conduit bodies (ells and tees):
    a. Body: Copper free aluminum with threaded hubs.
    b. Standard and mogul size.
    c. Cover:
        1) Screw down type with steel screws.
        2) Gasketed or non-gasketed galvanized steel or copper free aluminum.
4. Standard: UL 514B.

C. Fittings for Use with FLEX:

1. Connector:
    a. Zinc plated malleable iron.
    b. Squeeze or clamp-type.
2. Standard: UL 514B.

D. Fittings for Use with FLEX-LT:

1. Connector:
    a. Straight or angle type.
    b. Metal construction, insulated and gasketed.
    c. Composed of locknut, grounding ferrule and gland compression nut.
    d. Liquid tight.
2. Standards: UL 467, UL 514B.

E. Fittings for Use with Rigid Nonmetallic PVC Conduit:

1. Coupling, adapters and conduit bodies:
    a. Same material, thickness, and construction as the conduits with which they are used.
    b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
    c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

F. Weather and Corrosion Protection Tape:

1. PVC based tape, 10 mils thick.
2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
3. Used with appropriate pipe primer.

2.7 ALL RACEWAY AND FITTINGS

A. Mark Products:

1. Identify the nominal trade size on the product.
2. Stamp with the name or trademark of the manufacturer.

2.8 OUTLET BOXES

A. Metallic Outlet Boxes:

1. Hot-dip galvanized steel.
2. Conduit knockouts and grounding pigtail.
3. Styles:
    a. 2 inches x 3 inches rectangle.
    b. 4 inches square.
    c. 4 inches octagon.
    d. Masonry/tile.
4. Accessories:
    a. Flat blank cover plates.
    b. Barriers.
    c. Extension, plaster or tile rings.
    d. Box supporting brackets in stud walls.
    e. Adjustable bar hangers.

5. Standards: NEMA/ANSI OS 1, UL 514A.

B. Cast Outlet Boxes:

1. Zinc plated cast iron or die-cast copper free aluminum with manufacturer's standard finish.
2. Threaded hubs and grounding screw.
3. Styles:
   a. "FS" or "FD".
   b. "Bell".
   c. Single or multiple gang and tandem.
   d. "EDS" or "EFS" for hazardous locations.
4. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.
5. Standards: UL 514A, UL 1203.

C. See Specification Section 26 27 26 for wiring devices, wallplates and coverplates.

2.9 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:

1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
2. With or without concentric knockouts on four sides.
3. Flat cover fastened with screws.

B. NEMA 4 Rated:

1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
6. Cover with oil resistant gasket.

C. NEMA 4X Rated (metallic):

1. Body and cover: 14 GA Type 304 or 316 stainless steel.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged door and stainless steel screws and clamps.
6. Door with oil-resistant gasket.

D. Miscellaneous Accessories:

1. Rigid handles for covers larger than 9 square feet or heavier than 25 pounds.
2. Split covers when heavier than 25 pounds.
3. Weldnuts for mounting optional panels and terminal kits.
4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.

E. Standards: NEMA 250, UL 50.

2.10 SUPPORT SYSTEMS

A. Single Conduit and Outlet Box Support Fasteners:

1. Material requirements:
   a. Zinc plated steel.

b. Stainless steel.
c. Malleable iron.
d. PVC coat malleable iron or steel: 20 mil PVC coating.
e. Steel protected with zinc phosphate and oil finish.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

A. Shall be in accordance with the requirements of:

1. NFPA 70.
2. Manufacturer instructions.

B. Size of Raceways:

1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
2. Unless specifically indicated otherwise, the minimum raceway size shall be:
   a. Conduit: 3/4 inches.
   b. Wireway: 2-1/2 inches x 2-1/2 inches.

C. Field Bending and Cutting of Conduits:

1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
2. Do not reduce the internal diameter of the conduit when making conduit bends.
3. Prepare tools and equipment to prevent damage to the PVC coating.
4. Degrease threads after threading and apply a zinc rich paint.
5. Debur interior and exterior after cutting.

D. Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.

E. The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.

1. Repair galvanized components utilizing a zinc rich paint.
2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit; or a self-adhesive, highly conformable, cross-linked silicone composition strip, followed by a protective coating of vinyl tape.
   a. Total nominal thickness: 40 mil.
4. Repair surfaces which will be inaccessible after installation prior to installation.

F. Remove moisture and debris from conduit before wire is pulled into place.

1. Pull mandrel with diameter nominally 1/4 inches smaller than the interior of the conduit, to remove obstructions.
2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.

G. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

H. Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

I. Fill openings in walls, floors, and ceilings and finish flush with surface.

3.2 RACEWAY ROUTING

A. Raceways shall be routed in the field unless otherwise indicated.

1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
2. Run in straight lines parallel to or at right angles to building lines.
3. Do not route conduits:
   a. Through areas of high ambient temperature or radiant heat.
   b. In suspended concrete slabs.
   c. In concrete members including slabs, slabs on grade, beams, walls, and columns unless specifically located and detailed on structural Drawings..
4. Locate sleeves or conduits penetrating floors, walls, and beams so as not to significantly impair the strength of the construction. Do not place conduit penetrations in columns.
5. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
6. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.

B. All conduits within a structure shall be installed exposed except as follows:

1. As indicated on the Drawings.
2. Concealed above gypsum wall board or acoustical tile suspended ceilings.
3. Conduits in architecturally finished areas shall be concealed.

C. Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 feet:

1. Between instrumentation and telecommunication: 1 inch.
2. Between instrumentation and 125 V, 48 V and 24 VDC, 2 inches.
3. Between instrumentation and 600 V and less AC power or control: 6 inches.
4. Between instrumentation and greater than 600 VAC power: 12 inches.
5. Between telecommunication and 125 V, 48 V and 24 VDC, 2 inches.
6. Between telecommunication and 600 V and less AC power or control: 6 inches.
7. Between telecommunication and greater than 600 VAC power: 12 inches.
8. Between 125 V, 48 V and 24 VDC and 600 V and less AC power or control: 2 inches.
9. Between 125 V, 48 V and 24 VDC and greater than 600 VAC power: 2 inches.
10. Between 600 V and less AC and greater than 600 VAC: 2 inches.
11. Between process, gas, air and water pipes: 6 inches.

D. Conduits shall be installed to eliminate moisture pockets.

1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

E. Conduit shall not be routed on the exterior of structures except as specifically indicated on the Drawings.

F. Where sufficient room exists within the housing of roof-mounted equipment, the conduit shall be stubbed up inside the housing.

G. Provide all required openings in walls, floors, and ceilings for conduit penetration.

3.3 RACEWAY APPLICATIONS

A. Permitted Raceway Types Per Wire or Cable Types:

1. Power wire or cables: All raceway types.

2. Control wire or cables: All raceway types.
3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
5. Telecommunication cables: All raceway types.

B. Permitted Raceway Types Per Area Designations:

1. Dry areas:
   a. RGS.
   b. RAC.
   c. EMT.
2. Wet areas:
   a. RGS.

C. Permitted Raceway Types Per Routing Locations:

1. In stud framed walls:
   a. EMT.
2. In concrete block or brick walls:
   a. EMT.
3. Above acoustical tile ceilings:
   a. EMT.
   b. NEMA 1 rated wireway.
4. Embedded in poured concrete walls and floors:
   a. PVC-40.
   b. PVC-RGS when emerging from concrete into areas designated as wet, corrosive or highly corrosive.
5. Beneath floor slab-on-grade:
   a. PVC-40.
6. Direct buried conduits and ductbanks:
   a. PVC-40.
   b. PVC-80.
   c. 90 degrees elbows for transitions to above grade:
      1) PVC-RGS.
   d. Long sweeping bends greater than 15 degrees:
      1) PVC-RGS.

D. FLEX conduits shall be installed for connections to light fixtures, HVAC equipment and other similar devices above the ceilings.

1. The maximum length shall not exceed:
   a. 6 feet to light fixtures.
   b. 3 feet to all other equipment.

E. FLEX-LT conduits shall be installed as the final conduit connection to light fixtures, dry type transformers, motors, electrically operated valves, instrumentation primary elements, and other electrical equipment that is liable to vibrate.

1. The maximum length shall not exceed:
   a. 6 feet to light fixtures.
   b. 3 feet to motors.
   c. 2 feet to all other equipment.

3.4 CONDUIT FITTINGS AND ACCESSORIES

A. Conduit Seals:

1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.
2. Fill plug and drain shall be accessible.
3. Pour the conduit seals in a two-step process.
    a. Pour the seal and leave cover off.
    b. After seal is dry, inspect for proper sealing, install cover and mark (for example, paint or permanent marker) as complete.

B. Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.

1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.

C. Install Expansion Fittings:

1. Where conduits are exposed to the sun and conduit run is greater than 200 feet.
2. Elsewhere as identified on the Drawings.

D. Install Expansion/Deflection Fittings:

1. Where conduits enter a structure.
    a. Except electrical manholes and handholes.
    b. Except where the ductbank is tied to the structure with rebar.
2. Where conduits span structural expansions joints.
3. Elsewhere as identified on the Drawings.

E. Threaded connections shall be made wrench-tight.

F. Conduit joints shall be watertight:

1. Where subjected to possible submersion.
2. In areas classified as wet.
3. Underground.

G. Terminate Conduits:

1. In metallic outlet boxes:
    a. RGS:
        1) Conduit hub and locknut.
        2) Insulated bushing and two locknuts.
        3) Use grounding type locknut or bushing when required by NFPA 70.
    b. EMT: Compression type connector and locknut.
2. In NEMA 1 rated enclosures:
    a. RGS:
        1) Conduit hub and locknut.
        2) Insulated bushing and two locknuts.
        3) Use grounding type locknut or bushing when required by NFPA 70.
    b. EMT: Compression type connector and locknut.
3. When stubbed up through the floor into floor mount equipment:
    a. With an insulated grounding bushing on metallic conduits.
    b. With end bells on nonmetallic conduits.

H. Threadless couplings shall only be used to join new conduit to existing conduit when the existing conduit end is not threaded and it is not practical or possible to cut threads on the existing conduit with a pipe threader.

3.5 CONDUIT SUPPORT

A. Permitted multi-conduit surface or trapeze type support system per area designations and conduit types:

1. Dry or wet and/or hazardous areas:
    a. Galvanized system consisting of: Galvanized steel channels and fittings, nuts and hardware and conduit clamps.
    b. Aluminum system consisting of: Aluminum channels, fittings and conduit clamps with stainless steel nuts and hardware.

B. Permitted single conduit support fasteners per area designations and conduit types:

1. Architecturally finished areas:
    a. Material: Zinc plated steel, or steel protected with zinc phosphate and oil finish.
    b. Types of fasteners: Spring type hangers and clips, straps, hangers with bolts, clamps with bolts and bolt on beam clamps.
    c. Provide anti-rattle conduit supports when conduits are routed through metal studs.
2. Dry or wet and/or hazardous areas:
    a. Material: Zinc plated steel, stainless steel and malleable iron.
    b. Types of fasteners: Straps, hangers with bolts, clamps with bolts and bolt on beam clamps.

C. Conduit Support General Requirements:

1. Maximum spacing between conduit supports per NFPA 70.
2. Support conduit from the building structure.
3. Do not support conduit from process, gas, air or water piping; or from other conduits.
4. Provide hangers and brackets to limit the maximum uniform load on a single support to 25 LBS or to the maximum uniform load recommended by the manufacturer if the support is rated less than 25 pounds.
    a. Do not exceed maximum concentrated load recommended by the manufacturer on any support.
    b. Conduit hangers:
        1) Continuous threaded rods combined with struts or conduit clamps: Do not use perforated strap hangers and iron bailing wire.
    c. Do not use suspended ceiling support systems to support raceways.
    d. Hangers in metal roof decks:
        1) Utilize fender washers.
        2) Not extend above top of ribs.
        3) Not interfere with vapor barrier, insulation, or roofing.
5. Conduit support system fasteners:
    a. Use sleeve-type expansion anchors as fasteners in masonry wall construction.
    b. Do not use concrete nails and powder-driven fasteners.

3.6 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions.
2. See Specification Section 26 05 00 and the Drawings for area classifications.
3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:

1. Permitted uses of metallic outlet boxes:
    a. Housing of wiring devices:
        1) Recessed in all stud framed walls and ceilings.
        2) Recessed in poured concrete, concrete block and brick walls of architecturally finished areas and exterior building walls.
    b. Pull or junction box:
        1) Above gypsum wall board or acoustical tile ceilings.
        2) Above 10 feet in an architecturally finished area where there is no ceiling.
2. Permitted uses of cast outlet boxes:
    a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet, corrosive, highly corrosive and hazardous areas.
    b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.
3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00.
4. Set device outlet boxes plumb and vertical to the floor.
5. Outlet boxes recessed in walls:
    a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.
    b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.
6. Back-to-back are not permitted.

C. Pull and Junction Boxes:

1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
    a. Make covers of boxes accessible.
2. Permitted uses of NEMA 1 enclosure:
    a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.

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SECTION 26 09 46
DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Distributed digital control systems (for lighting) and appurtenances.

B. Related Requirements: Include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.
2. Section 26 27 26 - Wiring Devices.
3. Section 26 50 00 - Interior and Exterior Lighting.

1.2 REFERENCES

A. Referenced Standards:

1. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
2. Underwriters Laboratories (UL):
   a. 20, Plug Load Controls.
   b. 508, Industrial Control Equipment.
   c. 916, Energy Management Equipment.
   d. 924, Emergency Lighting.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer:
   a. Manufacturer of digital lighting controls shall possess not less than 10 years' satisfactory experience in manufacturing and furnishing technical support services for components comparable to those required by this Section.
2. Designer of Digital Lighting Control System:
   a. Entity that assists Contractor or Subcontractor with selecting the specific components of the digital lighting control systems shall be the associated product manufacturer's representative.
   b. Such entity shall have not less than five years of experience designing the associated manufacturer's digital lighting controls.
   c. Submit documentation of qualifications and experience to Engineer upon request.
3. Installer:
   a. Installer shall be certified by digital lighting control system's manufacturer.
   b. Installer shall have not less than three years of suitable experience installing digital lighting control systems.
   c. Submit documentation of qualifications and experience to Engineer upon request.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Composite wiring diagram, schematic diagram, or both, of each lighting system digital control circuit proposed.
   b. Floor plans:

1) Showing or indicating location of devices, including sensors, load controllers, and switches.
2) Proper identification of each system component, with exact nomenclature indicated for that device in the Contract Documents, and each component labeled with corresponding room number.

c. Schedule of each control station, indicating correct pushbutton engraving.

d. Detail drawings and narrative descriptions, indicating products and sequence of operation for each room and area, illustrating typical acceptable room and area connection topologies.

2. Product Data: Submit for each product proposed for use:

a. Catalog sheets and manufacturer's specifications.

b. Ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

B. Informational Submittals: Submit the following:

1. Supplier Instructions:

a. Storage and handling requirements and recommendations.

2. Field Quality Control Results:

a. Written results of field quality control activities required by the Contract Documents.

3. Qualifications Statements: Submit the following when required by Engineer:

a. Manufacturer.

b. Design-manufacturer's representative, including required certification by manufacturer.

c. Installer.

C. Closeout Submittals: Submit the following:

1. Operating and Maintenance Data: Operation and Maintenance Manuals. Include the following:

a. Record copies of required Action Submittals and Informational Submittals.

b. Sequence of operation, identifying operation for each room or space.

c. Sensor parameters, time delays, sensitivities, and daylighting setpoints.

d. Manufacturers maintenance information.

e. Operation and Maintenance data: Include detailed information on device programming and setup.

2. Record Documents: Record as-constructed, installed locations and settings for digital lighting control systems and components.

3. Warranty documentation required by the Contract Documents.

D. Maintenance Materials Submittals: Furnish the following and submit documentation of delivery to and acceptancy by Owner (or facility manager, if other than Owner):

1. One 0-10 VDC digital room controller, one relay.

2. One digital room controller, dual relay.

3. One occupancy sensor of each type installed in the Work.

1.5 FIELD CONDITIONS

A. Ambient Conditions:

1. Environmental Conditions Range.

a. Temperature: 32 to 104 degrees F.

b. Relative Humidity: 10 to 90%, non-condensing.

1.6 WARRANTY

A. Manufacturer's Special or Extended Warranty:

1. In addition to manufacturer's general, standard printed warranty, furnish manufacturer's special warranty covering materials and workmanship. Special warranty shall remain in effect for a period of five years commencing on the date of Substantial Completion for the associated Work.
2. Provide software and firmware updates and onsite software and firmware support for the specified extended warranty period indicated immediately above.
3. Provide unlimited technical hotline support for the duration of the extended warranty period specified in this provision.
4. Manufacturer's response time for onsite warranty service and system maintenance shall be within 72 hours of manufacturer's receipt of Owner's notice.
5. Comply with Section 01 78 36 - Warranties.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Distributed Lighting Control System: Subject to compliance with the Contract Documents, furnish products of one of the following:

1. Acuity nLight.
2. Encelium.
3. ETC.
4. Hubbell Control.
5. Legrand WattStopper.
6. Lutron.

2.2 SYSTEM DESCRIPTION

A. This Section is intended to describe performance and operational criteria, and associated services required to provide distributed digital lighting control systems for the area(s) shown or indicated in the Contract Documents. This Section is not intended to describe all details of required components and does not include all required components. Provide all components necessary and required for complete and operating systems.

B. Design and layout of digital lighting control systems shall be by lighting control system manufacturer and manufacturer's authorized, factory-trained representative. Digital lighting control systems shall be in accordance with lighting control strategy schedule on the Drawings.

C. Provide quantities of devices and devices at locations necessary and required for complete coverage of lighting for the respective room or area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors, lighting control panels, and accessories that suit the required lighting and electrical systems' parameters. Occupancy detection coverage shall not extend outside the respective room or area controlled.

D. System components shall be hard-wired. Battery powered wireless systems or components are unacceptable.

2.3 DIGITAL LIGHTING CONTROL SYSTEM LOCAL NETWORK

A. Digital lighting control system (DLCS) local network is free topology communication protocol.

B. DLCS Local Network:

1. Automatic configuration and binding of occupancy sensors, switches, and lighting loads to most energy-efficient sequence of operation, based on the associated device.
2. System shall facilitate replacement of each device in local DLCS network with standard off-the-shelf unit without requiring significant checkout and startup, configuration, or setup.
3. Push and Learn: Configuration to change automatic configuration, including binding and load parameters without tools, using only buttons on digital devices in associated local network.

4. Two-way infrared communications for control by handheld remotes, and configuration by handheld tool including adjusting load parameters, sensor configuration and binding, within line of sight of up to 30 feet from associated sensor, wall switch, or IR receiver.

C. Digital Room Devices:

1. Connect to local network using pre-terminated Cat 5e cables with RJ-45 connectors, to convey data to and from, and power to, room devices.
    a. Systems utilizing RJ-45 patch cords but do not provide serial communication data from individual end devices are unacceptable.

2.4 DIGITAL ROOM CONTROLLERS

A. Digital controllers for lighting loads shall automatically bind room loads to connected devices in associated room or space without special startup procedures by facility personnel and without tools. Provide room controllers appropriate for required room lighting control. Controllers shall not have dip switches or potentiometers. Controllers shall not require special configuration to properly perform standard applications.

B. Required Features: Controllers shall include the following:

1. Automatic room configuration to most energy-efficient operation sequence, based upon room's devices.
2. Simple Replaceability: Using default automatic configuration capabilities, room controller shall be capable of replacement with off-the-shelf controller.
3. Multiple room controllers connected together in local network must automatically communicate with each other, without requiring configuration or setup, so that individual load numbers are sequentially assigned using each controller's device identification tags from highest to lowest.
4. Device Status LED indicators shall indicate:
    a. Data is being transmitted.
    b. Device has electrical power.
    c. Status for each load.
    d. Configuration status.
5. Required quick installation features:
    a. Standard junction box mounting.
    b. Quick low voltage connections using standard RJ-45 patch cable.
6. Based on individual configuration, each load shall be capable of the following on being powered-up after loss-of-normal-power:
    a. Turn on to 100%.
    b. Turn off.
    c. Turn on to most-recent, prior level.
7. Each load shall be configurable to operate in following sequences, based on occupancy:
    a. Auto-"on"/Auto-"off" (follow "on" and "off").
    b. Manual-"on"/Auto-"off" (follow "off" only).
8. Polarity of each load output shall be reversible, via digital configuration, so that "on" is "off" and "off" is "on".
9. Provide BACnet object information for the following objects:
    a. Load status.
    b. Electrical current (when available).
    c. Total watts per controller.
    d. Schedule State: "Normal hours" or "after-hours".
    e. Demand response enable and disable.
    f. Room occupancy status.

g. Total watts for room lighting and plug loads.
h. Total room watts/SQFT.
i. Force “on”/“off” all loads.

10. UL 2043 plenum-rated.
11. Manual override and LED indication for each load.
12. Dual-voltage 120/277 VAC, 60 Hz, or 347 VAC, 60 Hz. 120/277V models rated for 20A total load, de-rating to 16A required for dimmed loads, forward phase dimming; 347 VAC models rated for 15-amp total load; plug load controllers carry application-specific UL 20 rating for receptacle control.
13. Zero cross circuitry for each load.
14. All digital parameter data programmed into individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller. Provide memory with expected life of not less than 10 years.

C. “On”/“Off” Room Controllers:

1. One-relay or two-relay configuration.
2. Efficient, 150mA switching power supply.
3. Three RJ-45 DLCS local network ports with integral strain relief and dust cover.

D. “On”/“Off”/Dimming Enhanced Room Controllers:

1. Real-time current monitoring.
2. Multiple relay configurations.
   a. One-relay, two-relay, or three-relay.
3. 250mA switching power supply.
4. Four RJ-45 DLCS local network ports with integral strain relief and dust cover.
5. One dimming output per relay.
   a. Zero to 10V Dimming:
      1) Where indicated, one 0 to 10V analog output per relay for controlling compatible ballasts and LED drivers.
      2) Zero to 10V output shall automatically open upon loss of electric power to room controller to ensure full light output from controlled lighting.
   b. Dimming Output Channel:
      1) Independently configurable minimum and maximum calibration trim level to set dimming range to match true dynamic range of connected ballast or driver.
   c. LED level indicators on bound dimming switches shall utilize maximum and minimum trim.
   d. Dimming Output Channel:
      1) Independently configurable minimum and maximum trim level to set dynamic range of output to 0-100% dimming range established by minimum and maximum calibration trim.
   e. Set calibration and trim levels per output channel.
      1) Devices that set calibration or trim levels per controller are unacceptable.
   f. Configuration:
      1) Digital.
      2) Devices that set calibration or trim levels per output channel via trim pots or dip-switches are unacceptable.
6. Each load shall have independently configurable preset on level for “normal hours” and “after hours” events to allow different dimmed levels established at start of both “normal hours” and “after hours” events.

7. Fade rates for dimming loads shall be specific to bound switch buttons, and load shall maintain default value for bound buttons that do not specify a unique value.
8. Provide capability for the following dimming attributes to be changed or selected using wireless configuration tool:
    a. Establish preset level for each load from 0 to 100%.
    b. Set high and low trim for each load.
    c. Set lamp burn-in time for each load, up to 100 hours.
9. Override button for each load shall provide the following functions:
    a. Press-and-release for “on”/“off” control.
    b. Press-and-hold for dimming control.

2.5 DIGITAL CEILING MOUNTED OCCUPANCY SENSORS

A. Provide ceiling mounted passive infrared (PIR), ultrasonic, or dual-technology (PIR and ultrasonic) digital occupancy sensors.

B. Digital occupancy sensors shall provide graphic liquid crystal display (LCD) for digital calibration and electronic documentation. Features shall include:

1. Digital calibration and pushbutton configuration for the following variables:
    a. Sensitivity: 0 to 100%, in 10% increments.
    b. Time delay: 1 to 30 minutes, in one-minute increments.
    c. Test Mode: Five second time delay.
    d. Detection Technology: Dual-technology activation, re-activation, or both.
    e. Walk-through mode.
2. Load parameters including “auto”/“manual-on”, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
3. Programmable control functionality, including:
    a. Provide each sensor with capability of being programmed to control specific loads within a local network.
    b. Provide sensor capable of activating one of 16 user-definable lighting scenes.
    c. Adjustable retrigger time period for manual-“on” loads. Load shall retrigger (turn “on”) automatically within a configurable period (default 10 seconds) after turning “off”.
    d. Provide dual-technology sensors, independently configurable trigger modes available for both “normal hours” (NH) and “after hours” (AH) periods. Program retrigger mode to use the following technologies:
        1) Ultrasonic and passive infrared.
        2) Ultrasonic or Passive Infrared (PIR).
        3) Ultrasonic only.
        4) PIR only.
    e. Independently configurable sensitivity settings for PIR and ultrasonic technologies (for dual-technology sensors) for both “normal hours” (NH) and “after hours” (AH) periods.
4. One or two RJ-45 port(s) for connection to DLCS local network.
5. Two-way infrared (IR) transceiver allowing remote programming through handheld startup tool and control by remote personal controls.
6. Device Status LED indicators, that user may disable for selected applications, including:
    a. PIR detection.
    b. Ultrasonic detection.
    c. Configuration mode.
    d. Load binding.
7. Provide capability of assignment of occupancy sensor to specific load within room without wiring or special tools.

8. Manual override of controlled loads.
9. Digital parameter data programmed into individual occupancy sensors shall be retained in non-volatile FLASH memory within the sensor. Memory shall have expected life of not less than 10 years.

C. BACnet object information shall be available for the following objects:

1. Detection state.
2. Occupancy sensor time delay.
3. Occupancy sensor sensitivity, passive infrared (PIR) and ultrasonic.

D. Units shall have no dip switches or potentiometers for field settings.

E. Multiple occupancy sensors may be installed in a room by connecting them to the free topology DLCS local network. No additional configuration will be required.

F. Provide isolated dry contacts for occupancy sensors where integrated control of HVAC or other automated equipment or systems are required.

2.6 DIGITAL WALL SWITCHES

A. Provide low-voltage momentary pushbutton switches in one-, two-, three-, four-, five-, and eight-button configurations as necessary. Color shall be in accordance with Section 26 27 26 - Wiring Devices. Wall switches shall include the following features:

1. Provide two-way infrared (IR) transceiver for use with personal and configuration remote controls.
2. Provide removable buttons capable of field replacement, with engraved buttons or alternate color buttons. Provide capability for button replacement without removing switch from wall.
3. Provide configuration LED on each switch that blinks to indicate data transmission.
4. Provide “load/scene status” LED indicating light on each switch button, with the following:
   a. Bi-level LED.
   b. Dim locator level indicating electrical power to switch.
   c. Bright status level indicating load or scene is active.
   d. Dimming switches shall include seven bi-level LED indicating lights to indicate load levels using 14 steps.
5. Programmable control functionality shall include:
   a. Capability of configuring button priority to any BACnet priority level, from 1 to 16, corresponding to networked operation allowing local actions to utilize life safety priority.
   b. Scene patterns capable of being saved to any button other than dimming rockers. Once set, buttons shall be capable of being digitally locked to prevent overwriting preset levels.
6. Digital parameter data programmed into each wall switch shall be retained in non-volatile FLASH memory within wall switch. Memory shall have an expected life of not less than 10 years.

B. Provide BACnet object information capability for the following objects:

1. Button state.
2. Switch lock control.
3. Switch lock status.

C. Provide two RJ-45 ports for connection to DLCS local network.

D. Multiple digital wall switches may be provided in a room by connecting switches to free topology DLCS local network. Additional configuration shall not be necessary for multi-way switching.

E. Provide capability of changing and selecting the following switch attributes via wireless configuration tool:

1. “Load and scene” button function with capability of being reconfigured for individual buttons (from “load” to “scene”, and vice versa).
    a. Individual button function capable of being configured to toggle, “on” only or “off” only.
    b. Individual scenes capable of being locked to prevent unauthorized change.
    c. “Fade up” and “fade down” times for individual scenes capable of being adjusted from zero seconds to 18 hours.
    d. Ramp rate capable of being adjusted for each dimmer switch.
    e. Switch buttons capable of being bound to any load on any load controller or relay panel; buttons are not load type dependent; each button capable of being bound to multiple loads.

2.7 STANDARD WALL SWITCHES

A. Provide wall switches in accordance with Section 26 27 26 - Wiring Devices, rated for the applicable environment. Provide contact closure interface modules to connect maintained contact switches to DLCS.

2.8 WALL SWITCHES IN HAZARDOUS (CLASSIFIED) LOCATIONS

A. Provide wall switches in accordance with Section 26 27 26 - Wiring Devices, rated for the applicable environment. Provide contact closure interface modules to connect maintained contact switches to DLCS.

2.9 DIGITAL DAYLIGHTING SENSORS

A. Digital Daylighting Sensors – General:

1. Provide digital daylighting sensors that work with load controllers and relay panels to provide automatic switching capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
2. Open loop sensors measure incoming daylight in the space and are capable of controlling up to three lighting zones.

B. Provide digital daylighting sensors with the following features:

1. Sensors’ internal photodiode shall measure light waves only within visible spectrum. Sensors’ photodiodes’ spectral response curve shall closely match entire photopic curve. Photodiodes shall not measure energy in either ultraviolet or infrared spectra. Provide each photocell with sensitivity of less than 5% for wavelengths less than 400 nanometers or greater than 700 nanometers.
2. Provide sensors with light level range from one to 6,553 foot-candles (fc).
3. Capability of “on”/“off” for each controlled zone, depending on selection of load controller(s) and load binding to controller(s).
4. For switching daylight harvesting, provide photosensors with field-selectable deadband, or separation, between “on setpoint” and “off setpoint”. Deadband or separation shall prevent controlled lights from cycling excessively after lights turn off.
5. For dimming daylight harvesting, provide photosensors with the option, when daylight contribution is sufficient, of turning controlled lights “off” or dimming controlled lights to field-selectable minimum level.
6. Photosensors shall have digital, independently configurable fade rate for both increasing and decreasing light level in units of “percent per second”.
7. Photosensors shall provide adjustable cut-“off” time. Cut-off time shall be defined by number of selected minutes associated load is at minimum output before load turns “off”. Provide selectable range between 0 to 240 minutes, with option to never cut-off.
8. Digital wall switch in the associated space shall allow occupants to override photosensor by reducing lighting level to increase energy savings or, when desired by occupants, by raising lighting levels for selectable period or cycle of occupancy.

9. Provide integral infrared (IR) transceiver for configuration and startup, via handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
10. Provide configuration LED status-indicating light on device that blinks to indicate data transmission.
11. Provide status LED light indicating test mode, override mode, and load binding.
12. Provide recessed switch on each device to turn controlled load(s) “on” and “off”.
13. BACnet object information shall be available for the following daylighting sensor objects, based on specific photocell’s settings:
    a. Light level.
    b. Day and night setpoints.
    c. “Off” time delay.
    d. “On” and “off” setpoints.
    e. Up to three zone setpoints.
    f. “On”/“off” operating mode.
14. Provide one RJ-45 port for connection to DLCS local network.
15. Provide choice of accessories to accommodate multiple mounting methods and building materials. Photosensors shall be capable of being mounted on a ceiling tile, skylight light well, suspended lighting fixture, or backbox. Standard tube photosensors shall accommodate mounting materials from zero to 0.62 inches thickness (LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 inches - 1.25 inches thickness. Provide mounting brackets compatible with junction boxes (LMLS-MB1) and wall mounting.
16. Provide capability for any load or group of loads in room to be assigned to a daylighting zone.
17. Each load within each daylighting zone shall be individually enabled or disabled for discrete control (load independence).
18. All digital parameter data programmed into each photosensor shall be retained in non-volatile FLASH memory within associated photosensor. Memory shall have expected life of not less than 10 years.

C. Open loop digital photosensors shall include the following additional features:

1. Internal photodiode that measures light in a 60 degrees angle (cutting off the unwanted light from room’s interior).
2. Automatically establishes application-specific setpoints after manual calibration using wireless configuration tool or personal computer with appropriate software. For switching operation, provide adequate dead band between “on” and “off” setpoints for each zone to prevent lights from cycling; for dimming operation, a proportional control algorithm shall maintain design lighting level in each zone.
3. Each of three discrete daylight zones shall include capability for any non-overlapping group of loads in room.

2.10 HANDHELD AND COMPUTER CONFIGURATION TOOLS

A. Provide a wireless configuration tool that facilitates optional customization of DLCS local networks using two-way infrared (IR) communications, while personal computer software connects to each local network via USB interface.

B. Features and functionality of wireless configuration tools shall include:

1. Two-way infrared (IR) communication with DLCS IR-enabled devices within range of approximately 30 feet.
2. High visibility organic LED (OLED) display, pushbutton user interface, and menu-driven operation.

3. Furnish with capability to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLCS devices by type and serial number.
4. Save up to eight occupancy sensors setting profiles and apply profiles to selected sensors.
5. Temporarily adjust light level of each load on the local network and incorporate those levels in scene setting. Set room mode for testing of “normal hours” (NH) and “after hours” (AH) parameter settings.
6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
7. Set room mode for testing of “normal hours” (NH) and “after hours” (AH) parameter settings.
8. Verify status of building level network devices.

2.11 EMERGENCY LIGHTING CONTROL DEVICES

A. Emergency Lighting Control Unit – General:

1. Provide UL 924-listed device that monitors switched circuit and provides normal lighting to area served.
2. Unit shall provide normal “on”/“off” control of emergency lighting, with the normal lighting.
3. Upon loss of normal electrical power, emergency lighting circuit shall close, forcing emergency lighting “on” until restoration of normal electrical power.
4. Required features include:
   a. Ballast Rating: 120/277V, 50/60 Hz, 20 amps.
   b. Push-to-test button.
   c. Auxiliary contact for remote test or fire alarm system interface.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to starting installation of digital lighting control systems:

1. Verify all spaces and surfaces where digital lighting control system Work will be installed are sufficiently ready for such Work.
2. Where permanent environmental controls, such as building envelope and heating, ventilating, and air conditioning systems are not yet sufficiently operable to reliably provide appropriate environment for digital lighting control system Work, provide necessary and required temporary enclosures and environmental controls prior to starting the Work of this Section.
3. Digital lighting control system manufacturer’s representative shall instruct Contractor and installer on controls system functionality and handling, storing, and installing materials and equipment.

3.2 INSTALLATION AND SERVICES

A. Installation – General:

1. Provide all Work required for properly operating digital lighting control systems, in accordance with the Contract Documents and manufacturer’s instructions. Where manufacturer’s instructions conflict with the Contract Documents, obtain written interpretation or clarification from Engineer.
2. Provide necessary and required electrical Work, including conduit, cabling, connections, hardware, and incidentals for properly functioning lighting control systems. Provide field devices, 0 to 10 V dimming ballasts, fixed output ballasts, 0 to 10 V LED drivers communication cabling, and others required by the Contract Documents.
3. Digital lighting control system Work shall perform properly, in accordance with the Contract Documents and manufacturer’s performance criteria (whichever is more-stringent).

4. Provide digital lighting control systems in accordance with Laws and Regulations, including, but not limited to, cabling types and requirements for separation from other circuits and cabling.
5. Install devices and cabling and tag line voltage connections to indicate circuit and switched legs.

B. Cabling for Digital Lighting Control Systems:

1. Connect room/area devices using device manufacturer's factory-tested Cat-5e cabling with pre-terminated RJ-45 connectors.
2. Low voltage cabling topology shall comply with device manufacturer's requirements.
3. Route network cabling as shown in Submittals approved by Engineer.
4. Document final cabling locations, routing, and topology on as-constructed record Drawings.
5. Low-voltage lighting control cabling provided without associated conduit shall be neatly placed within joist space above ceilings and properly supported.
6. Do not install such cabling on, or supported by, ceiling system.
7. Install in conduits low-voltage lighting control system cabling: installed in concealed in walls, installed above non-accessible ceilings, installed in exposed areas without ceilings, and other locations.

C. Lighting Control Devices:

1. Install lighting control devices in locations shown and indicated, using devices appropriately rated for the environment where device is installed, including, but not limited to, wet, corrosive, hazardous, high-temperature, low-temperature, and other environmental factors.
2. Install passive infrared (PIR) occupancy sensors in corridors and ultrasonic sensors in restrooms. All other occupancy sensors shall be dual-technology type.
3. Prior to startup:
    a. Calibrate sensor time delays and sensitivity to provide proper detection of occupants and energy savings.
    b. Adjust time delay so each controlled area remains lighted while occupied.

D. Electrical Power for Digital Lighting Control Systems:

1. Test branch load circuits for operation before connecting loads to sensor system load terminals.
2. De-energize circuits before installation.

E. Preparation for Startup:

1. Before system startup, test to ensure proper communication.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

1. Tests and Inspections – General:
    a. Perform the field tests and inspections indicated in this provision and elsewhere in the Contract Documents. Retain manufacturer's authorized service representative to assist Contractor and installer with performing such tests and inspections.
    b. Start units to confirm operation after electrical circuitry is energized with electrical power, prior to installation of wall stations and sensors.
    c. Test and adjust controls and safety devices (emergency relays, UL 924, UL 1008,.
    d. Lighting control devices will be defective if they do not pass tests and inspections.
    e. Submit to Engineer written report documenting successful testing and inspection of each digital lighting control system. Engineer's acceptance of such documentation is condition precedent to Substantial Completion.

f. Submit to Engineer documentation that lighting control systems were tested and verified that control devices, hardware, cabling, software, and appurtenances operate as intended and are calibrated, adjusted, programmed, and operate as required by the Contract Documents and manufacturer's written recommendations.

g. If manufacturer's pre-terminated Cat-5e cabling is not provided for the Work, test each cable after installation and furnish test results to Engineer and manufacturer.

2. Functional Tests:

a. Perform functional testing in accordance with Laws and Regulations, including applicable edition of International Energy Conservation Code, Section C408.3.1, and include in field quality control results Submittal.

b. Perform functional testing under guidance of manufacturer's authorized representative and in accordance with manufacturer's written recommendations.

3. Field Inspections and Verifications: Perform the following:

a. Verify communication over control cabling.

b. Map addresses of devices and submit documentation indicating addresses and locations of addresses.

c. Verify communication to wireless managers and system server.

d. Submit software configuration of occupancy sensors, light level sensors, wall stations and other contacts to suit Contract requirements.

e. Submit configuration and program lighting control sequences as described in Contract Documents.

f. Demonstrate to Engineer proper operation of complete system.

B. Defective Work:

1. Replace defective digital lighting control systems Work components, devices, and equipment.

2. Reconditioned replacements are unacceptable.

3. When required field quality control test or inspection reveals defective Work, correct the defect and reperform the tests and inspections until satisfactory results are obtained.

4. When defective Work is remedied using spare parts or extra materials in Owner's inventory, prompt replace the items, in accordance with the Contract Documents.

C. Manufacturer's Service:

1. Retain the services of manufacturer's factory-authorized service representative to:

a. Instructing installer's personnel in handling, storing, and installing materials and equipment, and instructing installer's personnel on operation of digital lighting control systems.

b. Performing system checkout, startup, and troubleshooting.

c. Assisting Contractor with performing required field quality control tests and inspections. Test and inspect components, assemblies, and equipment installations, including connections and system communications.

d.

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Branch circuit panelboards.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 10 14 00 – Identification Devices.
2. Section 26 05 00 - Electrical - Basic Requirements.
3. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. PB 1, Panelboards.
2. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
3. Underwriters Laboratories, Inc. (UL):
   a. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
   b. 67, Standard for Panelboards.

1.3 DEFINITIONS

A. Branch Circuit Panelboard: Bus rating of less than 400A or where labeled as Branch Circuit Panelboard on the Drawings.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data.
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. See Specification Section 26 05 00 for additional requirements.
2. Fabrication and/or layout drawings:
   a. Panelboard layout with alphanumeric designation, branch circuit breakers size and type, as indicated in the panelboard schedules.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
   a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
2. Panelboard schedules with as-built conditions.

C. Informational Submittals:

1. Service equipment marking and documentation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Eaton.
2. GE by ABB.
3. Square D by Schneider Electric.
4. Siemens Corporation.

2.2 MANUFACTURED UNITS

A. Standards: NEMA PB 1, NFPA 70, UL 50, UL 67.

B. Ratings:

1. Current, voltage, number of phases, number of wires as indicated on the Drawings.
2. Short Circuit Current Rating (SCCR) and/or Ampere Interrupting Current (AIC) ratings equal to or greater than the interrupting rating indicated on the Drawings or in the schedule.
    a. Series rating is not acceptable.
    b. When fault current or minimum interrupting rating is not indicated, use rating of upstream equipment or infinite bus calculation of transformer secondary.
3. Service Entrance Equipment rated when indicated on the Drawings or when shown to be fed from a utility source.

C. Construction:

1. Interiors factory assembled and designed such that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors.
2. Multi-section panelboards: Feed-through or sub-feed lugs.
3. Main lugs: Solderless type approved for copper and aluminum wire.

D. Bus Bars:

1. Main bus bars:
    a. Tin plated aluminum or tin-plated copper sized to limit temperature rise to a maximum of 65 degrees C above an ambient of 40 degrees C.
    b. Drilled and tapped and arranged for sequence phasing of the branch circuit devices.
2. Ground bus and isolated ground bus, when indicated on the Drawings: Solderless mechanical type connectors.
3. Neutral bus bars: Insulated 100% rated or 200% rated, when indicated on the Drawings and with solderless mechanical type connectors.

E. Overcurrent and Short Circuit Protective Devices:

1. Main overcurrent protective device:
    a. Molded case circuit breaker.
2. Branch overcurrent protective devices:
    a. Molded case circuit breaker.
3. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.
4. Factory installed.

F. Enclosure:

1. Boxes: Code gage galvanized steel, furnish without knockouts.
2. Trim assembly: Code gage steel finished with rust inhibited primer and manufacturers standard paint inside and out.

3. Branch circuit panelboard:
    a. Trims supplied with hinged door-in-door construction.
        1) Outer door:
            a) Allows access to the interior of the enclosure.
            b) Hinged to the enclosure.
            c) Opened by removal of screws or by operating a mechanical latch located behind the inner door.
        2) Inner door:
            a) Allows access to breakers (non-live parts).
            b) Hinged to outer door.
            c) Opened by operation of a keyed corrosion resistant chrome-plated combination lock and catch. Locks for all branch circuit panelboards keyed alike.
    b. Trims for surface mounted panelboards, same size as box.
    c. Trims for flush mounted panelboards, overlap the box by 3/4 inches on all sides.
    d. Nominal 20 inches wide and 5-3/4 inches deep with gutter space in accordance with NFPA 70.
    e. Clear plastic cover for directory card mounted on the inside of each door.
    f. Where NEMA 3R or NEMA 12 rating is indicated: Door gasketed.
    g. Where NEMA 4X is indicated: Stainless Steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated on the Drawings, in accordance with the NFPA 70, and in accordance with manufacturer's instructions.

B. Support panelboard enclosures from wall studs or modular channels support structure, per Specification Section 26 05 00.

C. Provide NEMA rated enclosure as indicated on the Drawings. Where enclosure type is not indicated, provide enclosure rating suitable for the atmosphere where equipment is installed.

D. Equipment Marking and Documentation:

1. Provide labeling per NFPA 70 and other applicable codes.
2. Service equipment:
    a. Arc-flash hazard warning label. (Ref. NFPA 70 Article 110.16(A) and (B))
    b. Available fault current label and documentation of the calculations made for compliance with marking requirements. (Ref. NFPA 70 Article 110.24)
3. Other than service equipment:
    a. Arc-flash hazard warning label. (Ref. NFPA 70 Article 110.16(A))
    b. Available fault current label. (Ref. NFPA 70 Article 408.6)
4. Identify (tag) all equipment and equipment components.
5. Provide labels and tags in accordance with Section 10 14 00.
6. Available fault current and other required label data from Coordinated Power System Study as required by the contract documents.

E. Provide each panelboard with a typed directory:

1. Identify all circuit locations in each panelboard with the load type and location served.
2. Use Owner-furnished mechanical equipment designation if different than designation indicated on the Drawings.
3. Use final building room names and numbers as identified by the Owner if different than designation indicated on the Drawings.

4. Identify spare overcurrent devices.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
    a. Wall switches.
    b. Receptacles.
    c. Device wallplates and coverplates.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.
2. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. WD 1, General Color Requirements for Wiring Devices.
    c. WD 6, Wiring Devices - Dimensional Requirements.
2. Underwriters Laboratories, Inc. (UL):
    a. 20, General-Use Snap Switches.
    b. 498, Standard for Attachment Plugs and Receptacles.
    c. 514A, Metallic Outlet Boxes.
    d. 894, Standard for Switches for Use in Hazardous (Classified) Locations.
    e. 943, Ground-Fault Circuit-Interrupters.
    f. 1010, Standard for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
    g. 1310, Standard for Class 2 Power Units.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
    a. Provide submittal data for all products specified in PART 2 of this Specification Section.
    b. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Wall switches and receptacles:
    a. Bryant Electric.
    b. Cooper Wiring Devices by Eaton.
    c. Hubbell Incorporated Wiring Device-Kellems.
    d. Leviton Manufacturing Company.

e. Legrand/Pass & Seymour.
f. Eaton Crouse-Hinds.
g. Appleton Electric Co.
h. Hubbell Killark.

2.2 WALL SWITCHES

A. Basic requirements unless modified in specific requirements paragraph of switches per designated areas or types:

1. Industrial Specification Grade.
2. Quiet action, snap switch.
3. Self-grounding with grounding terminal.
4. Back and side wired.
5. Solid silver cadmium oxide contacts.
6. Rugged thermoplastic and/or nylon housing and one-piece switch arm.
7. Ratings: 20 A, 120/277 VAC.
8. Switch handle type: Toggle.
9. Switch handle color: Gray.
10. Types as indicated on the Drawings:
    a. Single-pole.
    b. Double-pole.
    c. 3-way.
    d. 4-way.
    e. Momentary contact.
11. Standards: UL 20, UL 514A, NEMA WD 1, NEMA WD 6.

B. Specialty Switch Specific Requirements:

1. Momentary Contact Switch for Lighting Control:
    a. SPDT, 3-position, center “off”.
    b. Rating: 15A, 120/277VAC.

C. Architecturally Finished Area Specific Requirements:

1. Commercial Specification Grade.
2. Wallplate:
    a. 302 or 304 brushed finish stainless steel.
    b. Single or multiple gang as required.

D. Dry Non-architecturally Finished Area Specific Requirements:

1. Coverplate for use on surface mounted outlet boxes:
    a. Raised steel, galvanized.
    b. Single or multiple gang as required.
2. Wallplate for use on recessed outlet boxes:
    a. Steel, galvanized.
    b. 302 or 304 brushed finish stainless steel.
    c. Single or multiple gang as required.

E. Wet or Damp Non-Architecturally Finished or Exterior Area Specific Requirements:

1. Coverplate:
    a. Cast aluminum, gasketed, stainless steel hardware, natural, lacquer, or factory painted finish.

b. Operator type:
    1) Side mounted rocker type handle to operate snap switch.
    2) Front mounted lever type handle to operate snap switch.
    3) Push/pull operator to operate snap switch.
    4) Spring type door to cover snap switch.
c. Wet location rated.
d. Single or multiple gang as required.

2.3 RECEPTACLES

A. Basic requirements unless modified in specific requirements paragraph of receptacles and per designated areas:
    1. Industrial Specification Grade.
    2. Straight blade.
    3. Brass triple wipe line contacts.
    4. One-piece grounding system with double wipe brass grounding contacts and self-grounding strap with grounding terminal.
    5. Back and side wired.
    6. Rating: 20 A, 125 VAC.
    7. High impact nylon body.
    8. Receptacle body color:
        a. Normal power: Gray.
        b. Generator or UPS power: Red.
    9. Duplex or simplex as indicated on the Drawings.
    10. Configuration: NEMA 5-20R.
    11. Standards: UL 498, UL 514A, NEMA WD 1, NEMA WD 6.

B. Receptacle Type Specific Requirements:
    1. Basic receptacles:
        a. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
            1) Identification: Letters “WR” on face of receptacle.
    2. Ground Fault Circuit Interrupter (GFCI):
        a. Specification Grade.
        b. Class A protection.
        c. Feed through type.
        d. Test and reset buttons.
        e. Self-testing.
        f. Visual indicator light.
        g. Weather-resistant when located in exterior locations or interior damp or wet areas as indicated on the Drawings.
            1) Identification: Letters “WR” on face of receptacle.
        h. .
        i. Additional standards: UL 943.

C. Architecturally Finished Areas Specific Requirements:
    1.
    2. Wallplate:
        a. 302 or 304 brushed finish stainless steel.

b. Single or multiple gang as required.

D. Dry Non-Architecturally Finished Areas Specific Requirements:

1. Coverplate for use on surface mounted outlet boxes:
   a. Raised steel, galvanized.
   b. Single or multiple gang as required.
2. Wallplate for use on recessed outlet boxes:
   a. Steel, galvanized.
   b. Single or multiple gang as required.

E. Wet Non-architecturally Finished Areas Specific Requirements:

1. Coverplate:
   a. Extra-duty rated, weatherproof (NEMA 3R) while in use, gasketed, stainless steel hardware, copper-free aluminum, 3.2 inches minimum cover depth for #12 AWG cords.

F. Exterior Locations Specific Requirements:

1. Coverplate:
   a. Extra-duty rated, weatherproof (NEMA 3R) while in use, gasketed, stainless steel hardware, copper-free aluminum, 3.2 inches minimum cover depth for #12 AWG cord.

G. Special Purpose Receptacles:

1. NEMA configuration as indicated on the Drawings.
2. Coverplate: See requirements per area designations herein.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Mount devices where indicated on the Drawings and as scheduled in Specification Section 26 05 00.

C. See Specification Section 26 05 33 for device outlet box requirements.

D. Where more than one receptacle is installed in a room, they shall be symmetrically arranged.

E. Provide blank plates for empty outlets.

F. Momentary contact switches shall be installed and connected such that the up position is 'on only' and the down position is 'off only.'

END OF SECTION

SECTION 26 28 00

OVERCURRENT AND SHORT CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Low voltage circuit breakers.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C37.13, Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.
   b. C37.16, Low-Voltage Power Circuit Breakers and AC Power Circuit Protectors - Preferred Ratings, Related Requirements, and Application Recommendations.
   c. C37.17, Trip Devices for AC and General Purpose DC Low Voltage Power Circuit Breakers.
2. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
3. Underwriters Laboratories, Inc. (UL):
   a. 489, Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
   b. 943, Standard for Safety for Ground-Fault Circuit-Interrupters.
   c. 1066, Standard for Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. See Specification Section 26 05 00 for additional requirements.

B. Contract Closeout Information:

1. Operation and Maintenance Data.

C. Informational Submittals:

1. Reports:
   a. As-left condition of all circuit breakers that have adjustable settings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Circuit breakers:
   a. Eaton.
   b. GE by ABB.

c. Square D Company.
d. Siemens.

2.2 CIRCUIT BREAKERS

A. Molded Case Type:

1. General:
   a. Standards: UL 489.
   b. Unit construction.
   c. Over-center, toggle handle operated.
   d. Quick-make, quick-break, independent of toggle handle operation.
   e. Manual and automatic operation.
   f. All poles open and close simultaneously.
   g. Three position handle: On, off and tripped.
   h. Molded-in ON and OFF markings on breaker cover.
   i. One-, two- or three-pole as indicated on the Drawings.
   j. Current and interrupting ratings as indicated on the Drawings.
2. Thermal magnetic type:
   a. Inverse time overload and instantaneous short circuit protection by means of a thermal magnetic element.
   b. Frame size 150 amp and below:
      1) Non-interchangeable, non-adjustable thermal magnetic trip units.
   c. Frame sizes 225 to 400 amp (trip settings less than 400A):
      1) Interchangeable and adjustable instantaneous thermal magnetic trip units.
   d. Ground Fault Circuit Interrupter (GFCI) Listed:
      1) Standard: UL 943.
      2) One- or two-pole as indicated on the Drawings.
      3) Class A ground fault circuit.
      4) Trip on 5 mA ground fault (4-6 mA range).
3. Solid state trip type:
   a. Inverse time overload, instantaneous short circuit and ground fault protection by means of a solid state trip element, associated current monitors and flux shunt trip mechanism.
   b. Frame size 400 amp to 1200 amp (trip settings between 400 and 1200A):
      1) Standard rating.
      2) Interchangeable current sensor or rating plug.
      3) Adjustable long time pick-up setting.
         a) Adjustable from 50 to 100% of the current sensor or rating plug.
      4) Adjustable short time pick-up setting.
      5) Adjustable instantaneous pick-up.
      6) Fixed ground fault pick-up, when indicated on the Drawings.
   c. Adjustable arc energy-reducing maintenance system.
      1) Frame size 1200A or when indicated on the Drawings for less than 1200A frame size.
      2) Activate and deactivate without opening door and exposing operators to energized parts.
      3) System status indicator adjacent to activation switch.
   d. Frame size 1600 amp and above:
      1) 100% rated.

2) Interchangeable current sensor or rating plug.
3) Adjustable long time pick-up setting.
a) Adjustable from 50 to 100% of the current sensor or rating plug.
4) Adjustable long time delay setting.
5) Adjustable short time pick-up setting.
6) Adjustable instantaneous pick-up setting.
7) Adjustable ground fault pick-up setting, when indicated on the Drawings.
8) Adjustable ground fault delay setting, when indicated on the Drawings.

e. Adjustable arc energy-reducing maintenance system.
1) Activate and deactivate without opening door and exposing operators to energized parts.
2) System status indicator adjacent to activation switch.

4. Motor circuit protector:
a. Adjustable instantaneous short circuit protection by means of a magnetic or solid state trip element.
b. Sized for the connected motor.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Current and interrupting ratings as indicated on the Drawings.

B. Series rated systems not acceptable.

C. Devices shall be ambient temperature compensated.

D. Circuit Breakers:

1. Molded case circuit breakers shall incorporate the following, unless indicated otherwise on the Drawings:
a. Frame sizes 400 amp and less with trip setting less than 400A shall be thermal magnetic type.
b. Frame sizes ___400__ amp and larger shall be solid state trip type.
c. Motor circuit protectors sized for the connected motor.

3.2 FIELD QUALITY CONTROL

A. Adjustable Circuit Breakers:

1. Set all circuit breaker adjustable taps as defined on the Drawings, except adjust motor circuit protectors per the motor nameplate and NFPA 70 requirements.

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SECTION 26 28 16
SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Safety switches.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 26 05 00 - Electrical - Basic Requirements.
2. Section 26 28 00 - Overcurrent and Short Circuit Protective Devices.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. KS 1, Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum).
2. Underwriters Laboratories, Inc. (UL):
   a. 98, Enclosed and Dead-Front Switches.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. Provide a Summary Table or use Exhibit A that associates the safety switch features with connected equipment tag number. Exhibit A indicates minimum data required.
   c. See Specification Section 26 05 00 for additional requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following safety switch manufacturers are acceptable:

1. Eaton.
2. GE by ABB.
3. Square D by Schneider Electric.
4. Siemens Corporation.
5. Appleton by Emerson Electric Co.
6. Crouse-Hinds by Eaton.
7. Killark by Hubbell.

2.2 SAFETY SWITCHES

A. General:

1. Non-fusible or fusible as indicated on the Drawings.
2. Suitable for service entrance when required.
3. NEMA Type HD heavy-duty construction.
4. Switch blades will be fully visible in the OFF position with the enclosure door open.

5. Quick-make/quick-break operating mechanism.
6. Deionizating arc chutes.
7. Manufacture double-break rotary action shaft and switchblade as one common component.
8. Clear line shields to prevent accidental contact with line terminals.
9. Operating handle (except NEMA 7 and NEMA 9 rated enclosures):
    a. Red and easily recognizable.
    b. Padlockable in the OFF position.
    c. Interlocked to prevent door from opening when the switch is in the ON position with a defeater mechanism.

B. Ratings:

1. Horsepower rated of connected motor.
2. Voltage and amperage: As indicated on the Drawings.
3. Short circuit withstand:
    a. Non-fused: 10,000A.
    b. Fused: 200,000A.

C. Accessories, when indicated in PART 3 of this Specification Section or on the Drawings:

1. Neutral kits.
2. Ground lug kits.
3. Auxiliary contact kits:
    a. Opens before main switch.
    b. Rated 10A at 125/250 VAC.
    c. One N.O. and one N.C. contact.

D. Enclosures:

1. NEMA 1 rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
    b. With or without knockouts, hinged and lockable door.
2. NEMA 3R rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
    b. With or without knockouts, hinged and lockable door.
3. NEMA 4 rated:
    a. Body and cover: Sheet steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
    b. No knockouts, external mounting flanges, hinged, gasketed and lockable door.
4. NEMA 4X rated (metallic):
    a. Body and cover: Type 304 or 316 stainless steel.
    b. No knockouts, external mounting flanges, hinged and gasketed door.
5. NEMA 4X rated (nonmetallic):
    a. Body and cover: Ultraviolet light protected fiberglass-reinforced polyester boxes.
    b. No knockouts, external mounting flanges, hinged, gasketed and lockable door.

E. Overcurrent and short circuit protective devices:

1. Fuses.
2. See Specification Section 26 28 00 for overcurrent and short circuit protective device requirements.

F. Standards: NEMA KS 1, UL 98.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.

B. Install switches adjacent to the equipment they are intended to serve unless otherwise indicated on the Drawings.

C. Provide auxiliary contact kit on local safety switches for motors being controlled by a variable frequency drive.

1. The VFD is to be disabled when the switch is in the open position.

D. Permitted uses of NEMA 1 enclosure:

1. Surface or flush mounted in areas designated dry in architecturally finished areas.

E. Permitted uses of NEMA 3R enclosure:

1. Surface mounted in exterior location for HVAC equipment only.

F. Permitted uses of NEMA 4 enclosure:

1. Surface mounted in areas designated as wet.

G. Permitted uses of NEMA 4X metallic enclosure:

1. Surface mounted in areas designated as wet and/or corrosive.

H. Permitted uses of NEMA 4X nonmetallic enclosure:

1. Surface mounted in areas designated as corrosive.
2. Surface mounted in areas designated as highly corrosive.

END OF SECTION

EXHIBIT A

Safety Switch Summary Table					
Equipment Tag	Switch Model Number	Rated Amps	Fused / Non-fused	Enclosure Type	Accessories
Example	Per MFR	60A	NF	NEMA 4X non-metallic	Ground lug, Aux Contact

SECTION 26 43 13

SURGE PROTECTION DEVICES FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Type PC3 SPD - Medium exposure locations (switchboard, panelboard and motor control center), integrally mounted.

B. Related Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C62.41, Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits.
   b. C62.41.1, Guide on the Surge Environment in Low-Voltage (1000V and Less) AC Power Circuits.
   c. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits.
   d. C62.45, Recommended Practice on Surge Testing For Equipment Connected to Low-Voltage (1000V and Less) AC Power Circuits.
2. Military Standard:
   a. MIL-STD-220B, Method of Insertion Loss Measurement.
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
4. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
5. Underwriters Laboratories, Inc. (UL):
   a. 1283, Standard for Electromagnetic Interference Filters.
   b. 1449, Standard for Surge Protective Devices.

B. Qualifications:

1. Provide devices from a manufacturer who has been regularly engaged in the development, design, testing, listing and manufacturing of SPDs of the types and ratings required for a period of 10 years or more and whose products have been in satisfactory use in similar service.
   a. Upon request, suppliers or manufacturers shall provide a list of not less than three customer references showing satisfactory operation.

1.3 DEFINITIONS

A. Clamping Voltage:

1. The applied surge shall be induced at the 90 degrees phase angle of the applied system frequency voltage.
2. The voltage measured at the end of the 6 inches output leads of the SPD and from the zero voltage reference to the peak of the surge.

B. Let-Through Voltage:

1. The applied surge shall be induced at the 90 degrees phase angle of the applied system frequency voltage.

2. The voltage measured at the end of the 6 inches output leads of the SPD and from the system peak voltage to the peak of the surge.

C. Maximum Continuous Operating Voltage (MCOV): The maximum steady state voltage at which the SPD device can operate and meet its specification within its rated temperature.

D. Maximum Surge Current:

1. The maximum 8 x 20 microsecond surge current pulse the SPD device is capable of surviving on a single-impulse basis without suffering either performance degradation or more than 10% deviation of clamping voltage at a specified surge current.
2. Listed by mode, since number and type of components in any SPD may very by mode.

E. MCC: Motor Control Center.

F. Protection Modes: This parameter identifies the modes for which the SPD has directly connected protection elements, i.e., line-to-neutral (L-N), line-to-line (L-L), line-to-ground (L-G), neutral-to-ground (N-G).

G. Surge Current per Phase:

1. The per phase rating is the total surge current capacity connected to a given phase conductor.
   a. For example, a wye system surge current per phase would equal L-N plus L-G; a delta system surge current per phase would equal L-L plus L-G.
   b. The N-G mode is not included in the per phase calculation.

H. System Peak Voltage: The electrical equipment supply voltage sine wave peak (i.e., for a 480/277 V system the L-L peak voltage is 679V and the L-N peak voltage is 392 V).

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Manufacturer's qualifications.
   b. Standard catalog cut sheet.
   c. Electrical and mechanical drawing showing unit dimensions, weights, mounting provisions, connection details and layout diagram of the unit.
   d. Testing procedures and testing equipment data.
   e. Create a Product Data Sheet for each different model number of SPD provided (i.e., Model XYZ with disconnect and Model XYZ without disconnect, each require a Product Data Sheet).
      1) Data in the Product Data Sheet heading:
         a) SPD Type Number per PART 2 of the Specification.
         b) Manufacturer’s Name.
         c) Product model number.
      2) Data in the Product Data Sheet body:
         a) Column one: Specified value/feature of every paragraph of PART 2 of the Specification.
         b) Column two: Manufacturer’s certified value confirming the product meets the specified value/feature.
         c) Name of the nationally recognized testing laboratory that preformed the tests.
         d) Warranty information.
      3) Data in the Product Data Sheet closing:
         a) Signature of the manufacturer’s official (printed and signed).
         b) Title of the official.
      4) Date of signature.

B. Operation and Maintenance Manuals.

1. Warranty.

1.5 WARRANTY

A. Minimum of a five year Warranty from date of shipment against failure when installed in compliance with applicable national/local electrical codes and the manufacturer's installation, operation and maintenance instructions.

PART 2 - PRODUCTS

2.1 GENERAL

A. Standards: IEEE C62.41.1, IEEE C62.41.2, IEEE C62.45, MIL-STD 220B, UL 1283, UL 1449.

2.2 TYPE PC3 SPD

A. Product:

1. Integrally mounted in panelboards.
2. Hybrid solid state high performance suppression system.
    a. Do not use gas tubes, spark gaps or other components in suppression system which might short or crowbar the line resulting in interruption of normal power flow to connected loads.
3. Do not connect multiple SPD modules in series to achieve the specified performance.
4. Designed for parallel connection.
5. Field connection: Use mechanical or compression lugs for each phase, neutral and ground that will accept bus bar or #10 through #1/0 conductors.
6. Device monitor:
    a. Long-life, solid state, externally visible indicators and Form C contact(s) that monitor the on-line status of each mode of the units suppression filter system or power loss in any of the phases.
    b. A fuse status only monitor system is not acceptable.

B. Operating Voltage: The nominal unit operating voltage and configuration as indicated on the Drawings.

C. Modes of Protection: All modes.

1. Single phase (2 pole): L-L, L-N, L-G and N-G.
2. Single phase: L-N, L-G and N-G.

D. Maximum Continuous Operating Voltage: Less than 130% of system peak voltage.

E. Operating Frequency: 45 to 65 Hz.

F. Short Circuit Rating: Equal to or greater than rating of equipment SPD is connected to.

G. Maximum Surge Current: 160,000 A per phase, 80,000 A per mode minimum.

H. Minimum Repetitive Surge Current Capacity: 4000 IEEE C High or B combination waveform impulses with no degradation of more than 10% deviation of the clamping voltage.

I. SPD Protection:

1. Integral unit level and/or component level overcurrent fuses and sustained overvoltage thermal cutout device.
2. An IEEE B combination wave shall not cause the fuse to open and render the SPD inoperable.

J. Maximum Clamping Voltages: Dynamic test at the 90 degrees phase angle including 6 inches lead length and measured from the zero voltage reference:

System Voltage	Test Mode	IEEE C62.41		UL 1449
		B Comb. Wave	B3 Ring Wave	
L-L < 250 V **L-N < 150 V**	L-L	1000 V	700 V	800 V
	L-N	600 V	400 V	500 V
	L-G	800 V	550 V	600 V
	N-G	800 V	550 V	600 V
L-L > 250 V **L-N > 150 V**	L-L	2000 V	1400 V	1800 V
	L-N	1150 V	800 V	1000 V
	L-G	1550 V	1000 V	1200 V
	N-G	1550 V	1000 V	1200 V

K. EMI-RFI Noise Rejection: Attenuation greater than 30 dB for frequencies between 100 kHz and 100 MHz.

2.3 SOURCE QUALITY CONTROL

A. SPD approvals and ratings shall be obtained by manufacturers from nationally recognized testing laboratories.

B. The SPD are to be tested as a complete SPD system including:

1. Integral unit level and/or component level fusing.
2. Neutral and ground shall not be bonded during testing.
3. 6 inches lead lengths.
4. Integral disconnect switch when provided.

C. The “as installed” SPD system including the manufacturers recommended circuit breaker, the SPD is connected to, will not open when tested with a IEEE C3 combination waveform.

D. Tests to be performed in accordance with IEEE C62.45:

1. Clamping voltage performance testing using IEEE C62.41 Category waveforms.
2. Single pulse surge current capacity test.
3. Repetitive surge current capacity testing.
4. Spectrum analysis for EMI-RFI noise rejection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Type PC3 SPD:

1. Connected in parallel to the equipment.
2. Install in dedicated electrical equipment compartment, bucket or panelboard box at the factory before shipment.
3. Provide leads that are as short and straight as possible.
4. Maximum lead length: 6 inches.
5. Connect leads to the equipment to be protected by one of the following means:
   a. Through a circuit breaker or molded case switch mounted in the equipment.
   b. Use manufacturer recommended circuit breaker size.
   c. Circuit breaker or switch to be operable from the equipment exterior or from behind a hinged door.

END OF SECTION

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SECTION 26 50 00
INTERIOR AND EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for:
    a. Interior building and exterior building mounted luminaires.
    b. Exterior and site luminaires.
    c. LEDs.
    d. Drivers.
    e. Light poles.

B. Related Specification Sections include but are not necessarily limited to:

1. Division 03 - Concrete.
2. Section 26 05 00 - Electrical - Basic Requirements.
3. Section 26 05 19 - Wire and Cable - 600 Volt and Below.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American National Standards Institute (ANSI):
    a. C78.377, Specification for the Chromaticity of Solid State Lighting Products.
2. Federal Communications Commission (FCC):
    a. Code of Federal Regulations (CFR), 47 CFR 18, Industrial, Scientific and Medical Equipment.
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
    a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
4. Illuminating Engineering Society of North America (IESNA):
    a. LM-79, Electrical and Photometric Measurements of Solid-State Lighting Products.
    b. LM-80, Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules.
5. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. 410, Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts.
    c. LE 4, Recessed Luminaires, Ceiling Compatibility.
6. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
    a. SSL 1, Electronic Drivers for LED Devices, Arrays or Systems.
7. National Fire Protection Association (NFPA):
    a. 70, National Electrical Code (NEC).
    b. 101, Life Safety Code.
8. Underwriters Laboratories, Inc. (UL):
    a. 248-4, Low-Voltage Fuses - Part 4: Class CC Fuses.
    b. 844, Standard for Luminaires for Use in Hazardous (Classified) Locations.
    c. 924, Standard for Emergency Lighting and Power Equipment.

d. 1012, Power Units Other Than Class 2.
e. 1310, Standard for Class 2 Power Units.
f. 1598, Luminaires.
g. 8750, Standard for Light Emitting Diode (LED) Equipment for Use in Lighting Products.

9. United States Department of Energy (USDOE):
   a. EPAct, the National Energy Policy Act.

1.3 DEFINITIONS

A. Useful Life for LED luminaire light sources:

1. The operating hours before reaching 70% of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions.
2. This is also known as 70% "Rated Lumen Maintenance Life" as defined in IESNA LM-80.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data:
   a. Provide submittal data for all products specified in PART 2 of this Specification Section.
   b. Identify luminaire by Luminaire Schedule designation.
   c. Luminaire data sheet:
      1) Name of manufacturer.
      2) Complete order information (catalog number).
      3) Description of construction and optics.
      4) Total input wattage.
      5) Luminous efficacy (lumens/Watt).
      6) Photometric performance data including candlepower distribution and coefficient of utilization (CU) table.
      7) Dimensional size.
      8) Weight.
      9) UL nameplate data for luminaires used in Class 1, Division 1 and 2 areas.
      10) Effective Projected Areas (EPA) for pole mounted luminaires.
   d. Solid state Luminaire additional data:
      1) Voltage.
      2) Initial and IES L70 lumens.
      3) Luminous efficacy (lumens/Watt).
      4) Correlated Color Temperature (CCT).
      5) Color Rendering Index (CRI).
      6) Total Harmonic Distortion (THD).
      7) Lamp life.
      8) Driver manufacturer and model number.
      9) Driver life.
      10) Driver type (0-10V, constant voltage, constant current).
      11) Dimming range and control device compatibility.
      12) Remote driver: Maximum wire length to luminaire.
      13) Emergency battery driver:
         a) Compatibility with lighting module.
         b) Lumen output of lighting module in emergency operation.
         c) Battery life.

d) Description of testing.
e) Ambient operating temperature.
14) Toxicity Characteristic Leaching Procedure (TCLP) compliance.
15) DesignLights Consortium (DLC) Listing.
16) Warranty information.
e. Pole data sheet:
1) Name of manufacturer.
2) Complete order information (catalog number).
3) Description of construction.
4) Length, shaft size and thickness.
5) Wind loading (available luminaire EPA per wind speed).
6) Anchor bolt template.
7) Bolt size and material.
f. See Specification Section 26 05 00 for additional requirements.
2. Test Reports:
a. IESNA LM-79 Test Report for Solid-State Luminaire.
b. IESNA LM-80 Test Report Solid-State Light Source.
3. Certifications: Solid-state Luminaire Useful Life Certificate.

B. Contract Closeout Information:

1. Operation and Maintenance Data:
a. See Specification Section 01 78 23 for requirements for the mechanics, administration, and the content of Operation and Maintenance Manual submittals.
b. Submittal data for each component covered by warranty.
c. Warranty.

1.5 WARRANTY

A. Minimum of a five year Warranty from date of manufacture against failure for solid-state luminaire including LED arrays, LED drivers and integral control devices. The solid-state product is considered defective if more than 15% of the individual light emitting diodes fail to illuminate.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Luminaires: Per Luminaire Schedule [or equal].
2. Solid State Light Sources:
a. Cree.
b. Xicato.
c. Luminaire manufacturer’s proprietary system.
3. LED Driver: Luminaire manufacturer's standard.
4. Emergency ballasts:
a. Iota Engineering.
b. Philips Bodine.
5. Emergency transfer devices: Philips Bodine.
6. Poles: Luminaire manufacturer's standard.

2.2 GENERAL REQUIREMENTS

A. Luminaires complete with LED modules and drivers.

B. Rated for area classification as indicated on the Drawings.

1. In Class I, Division 1 and 2 areas, the temperature rating of the luminaires and LED combination shall not exceed the auto-ignition temperature of the atmosphere in which the Luminaire is used.

C. Provide all recessed luminaires with gaskets of rubber, fiberglass, or equivalent material to prevent light leaks around flush trim.

1. Provide recessed luminaires with trim gaskets cemented in proper position.

D. Provide standard plaster frame for all recessed luminaires installed in plaster walls or ceilings.

1. Design, finish and fabricate material to preclude possibility of rust stain in plaster.

E. Coordinate luminaire mounting where recessed into building canopies prior to Submitting Shop Drawings. Confirm clearances and luminaire flange compatibility with construction.

F. Electrical components of recessed luminaires shall be accessible and removable through luminaire without having to remove luminaire from ceiling.

G. No live parts normally exposed to contact.

H. When intended for use in wet areas: Mark luminaire "Suitable for wet locations."

I. When intended for use in damp areas: Mark luminaire "Suitable for damp locations" or "Suitable for wet locations."

2.3 LUMINAIRES

A. Standards and Listings:

1. DesignLights Consortium (DLC).
2. UL 1598.
3. UL 844 for hazardous locations.
4. NEMA LE 4 for recessed locations.

B. Housings:

1. As indicated in the Luminaire Schedule and the following:
   a. Troffer luminaires:
      1) Minimum 22 gage sheet steel.
      2) Integral end plates and trim flanges to suit ceiling construction.
      3) Wire way covers with captive retainers to allow access to electrical components without use of tools.
   b. Down Light luminaires:
      1) Minimum 22 gage sheet steel, or minimum 16 gage sheet aluminum, unless noted otherwise.
      2) Auxiliary junction box secured to mounting frame.
   c. Extruded aluminum housings, where scheduled, shall be at least 1/8 inches thick.
   d. Punch and form housings prior to finishing (post-paint).

C. Trim (Recessed Mounted):

1. As indicated in the Luminaire Schedule and the following:
   a. For square and rectangular luminaires, miter and continuously weld corners.
   b. Miter perimeter inverted T-Bar angles at corners.
   c. Do not butt or overlap squared ends.
   d. Finish joints smooth.

D. Castings:

1. As indicated in the Luminaire Schedule and the following:
    a. Uniform quality, free from imperfections affecting strength and appearance.
    b. Exterior surfaces, if not receiving a finish coat, shall be smooth and match adjacent surfaces. At least one coat of clear methacrylate lacquer shall be applied unless a painted finish is specified.

E. Fasteners:

1. As indicated in the Luminaire Schedule and the following:
    a. Aluminum or steel luminaires: Zinc-Nickel plated, stainless steel, or equivalent.
    b. Stainless steel luminaires: Stainless steel.
    c. Bronze luminaires: Bronze or stainless steel.
    d. Non-metallic luminaires: Stainless steel.

F. Finishes:

1. As indicated in the Luminaire Schedule and the following:
    a. Painted surfaces:
        1) Manufacturer's standard metal pretreatment and baked or air-dried, light-stabilized enamel finish, acrylic, alkyd, epoxy, polyester, or polyurethane.
        2) White finishes shall have minimum 85% reflectance.
    b. Unpainted surfaces:
        1) Interior: Clear anodic coating, satin finish.
        2) Exterior: Clear anodic coating.

G. Lens/Louver Frames:

1. As indicated in the Luminaire Schedule and the following:
    a. Extruded aluminum with mitered corners.
    b. Hinging or other normal motion shall not cause lens or louver to drop out.
    c. No light leak between frame and housing.

H. Lenses:

1. As Indicated in the Luminaire Schedule and the Following:
    a. 100% virgin, UV stabilized acrylic.
    b. Held securely in place but must also be removable for cleaning and servicing.
    c. Luminaires with directional lenses shall include a lens orientation device to ensure that lens installation provides light distribution as designed.
    d. No light leaks between the lens and the luminaire.

I. Reflectors:

1. As Indicated in the Luminaire Schedule and the Following:
    a. Down Light Reflector and Baffle Finishes: First-quality "Alzak" anodized specular finish.
    b. Troffer reflector finish: Integral reflectors shall be painted white after fabrication with a minimum reflectance value of 90%.

J. Gaskets:

1. As Indicated in the Luminaire Schedule and the Following:
    a. Gaskets at face plates or frames of recessed luminaires which serve as ceiling trim and allow interior access.
    b. Moisture seal gaskets at exterior locations and in other designated wet areas.
    c. Secure frames to luminaire bodies with screws or other means, to result in tight installation, without light leaks.

K. Ventilation:

1. Ventilation openings of adequate size and quantity to permit operation of driver without affecting rated output or life expectancy. Include wire mesh screens.

L. Wiring:

1. Factory-wired to be compatible with the project electrical and controls systems.

M. Mounting Accessories:

1. Provide appropriate mounting accessories for each luminaire, compatible with various structural conditions encountered.
2. All luminaires with adjustable beam angles shall have a locking device to ensure that the beam distribution is not effected during servicing or cleaning.
3. Recessed Luminaires:
   a. Plaster Frames: Provide frames for luminaires installed in gypsum board and concealed suspension system ceiling tile. Make frames of non-ferrous metal or suitably rustproof after fabrication.
   b. Baffles and Gaskets: As required to prevent light leakage.
   c. Flanged luminaires are required in all ceiling systems except exposed grid lay-in panel type.
4. Luminaire Suspension Material:
   a. Unfinished Spaces:
      1) 1/2 inches minimum diameter swivel stem, unless otherwise noted.
      2) Safety chain on high bay type.
   b. Finished Spaces: Unless otherwise noted.
      1) Manufactured cable or stem and outlet box canopy.
         a) Contemporary design with swivel self-aligning features.
         b) Size canopy to cover outlet box, minimize size of canopy not associated with outlet box.
         c) Finish to match luminaire.
      2) Coordinate pendant location with ceiling tiles/ceiling grid.
         a) Submit coordinated mounting accessories as part of Shop Drawing submission.
      3) Luminaires mounted on suspended ceiling grids should be provided with outlet box designed for grid mounting with direct cord entry and supported by outlet box.

2.4 SOLID-STATE LUMINAIRES - ADDITIONAL REQUIREMENTS

A. Standards:

1. IESNA LM-79, IESNA LM-80.
2. NEMA SSL 1.
3. UL 1012, 1310, and 8750.
4. UL 844 for hazardous locations.

B. Solid state modules and driver to be provided and warrantied by luminaire manufacturer.

C. Solid-State Modules:

1. Uniform color temperature of 4000K unless otherwise noted on the Luminaire schedule.
   a. Color temperature measurement shall have a maximum 3 SDCM on the MacAdam Ellipse for frosted lensed luminaires, and 2 SDCM for other luminaire types (ANSI C78.377).
2. Minimum color rendering index (CRI) of 80 for indoor and 70 for outdoor applications.
3. LED module light output and efficacy: Measured in accordance with IESNA LM-79 standards.

4. LED useful life and lumen maintenance: Measured in accordance with IESNA LM-80 standards.
5. Driver and LED module: Minimum useful life of 50,000 hours (L70).
6. Individual LEDs connected such that a failure of one LED will not result in a light output loss of the entire luminaire.

D. Driver:

1. Compatible with solid-state modules and control devices specified.
2. Operate from 60 Hz input source of 120V through 277V with sustained variations of ±10% (voltage and frequency).
3. Input current Total Harmonic Distortion (THD): Less than 20% when operated at nominal line voltage.
4. Power Factor: Greater than 0.90.
5. Avoid interference with infrared devices and eliminate visible flicker.
6. Comply with ANSI C62.41 Category A for Transient protection.
7. Comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
8. Dimmable drivers capable of continuous dimming over a range of 100% to 10% of rated lumen output, unless otherwise specified in Luminaire Schedule. Dimming controlled by a 0 - 10 VDC signal, unless otherwise specified in Luminaire Schedule.
9. Control device must be compatible with type of driver and coordinated prior to submission of Shop Drawings. List of compatible dimming controllers must include the range of perceived brightness. No visible flicker throughout the dimming range.
10. Remote-mounting:
    a. Provide maximum allowable distances for secondary wire runs to luminaires.
    b. Provide remote mounting hardware and enclosures as required.
11. Operating temperature range must be suitable for site temperature conditions within exterior and gasketed luminaires.

E. Emergency Battery Driver:

1. UL 924.
2. Confirm compatibility with LED modules utilized.
3. Consist of a high temperature, maintenance-free nickel cadmium battery, charger, and electronic circuitry.
4. A solid state charging indicator light to monitor the charger and battery.
5. Single-pole test switch.
6. The following product family shall be selected based on coordination with LED lamp type:
    a. Philips Bodine “BSL23C”: can operate up to 4.5W at 410mA.
    b. Philips Bodine “BSL26C”: can operate up to 5.1W at 265mA.
    c. Philips Bodine “BSL722 inches: can operate up to 23W at 770mA.
    d. Philips Bodine “BSL23C”: can operate up to 23W at 770mA in operating conditions ranging from -20 degrees C (-4 degrees F) to 60 degrees C (140 degrees F).
    e. Alternate manufacturer: Iota.

F. Luminaire properly heat sinked to assure LED junction temperature ratings are not exceeded.

1. Provide ambient operating temperature range for which product is warrantied.

2.5 POLES

A. As Indicated in the Luminaire Schedule and the Following:

1. Designed for attached luminaire EPA with a ___90__ MPH maximum wind velocity at the base with a 1.3 wind gust factor.
2. Additional features:
    a. Handhole near base of pole.
    b. Grounding lug accessible at handhole.
    c. Galvanized anchor bolts.
    d. Anchor bolt covers.
    e. Vibration dampener(s).

2.6 MAINTENANCE MATERIALS

A. Furnish a minimum of 10% of total of each type and amperage of fuses for fixtures indicated to be fused.

B. Spare parts are to be stored in a box clearly labeled as to its contents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Coordinate Luminaire Types with Ceiling Construction:

1. Provide mounting hardware for the ceiling system in which the luminaire is to be installed.

B. Fasten luminaires supported by suspended ceiling systems to ceiling framing system with hold down clips.

C. Provide mounting brackets and/or structural mounting support for wall-mounted luminaires.

1. Do not support luminaire from conduit system.
2. When luminaire is supported from outlet boxes, install per NFPA 70.
3. Supports for luminaire mounted on exterior walls shall not be attached to exterior face of the wall.

D. Support surface mounted luminaires from the building structure and not from the ceiling suspension system.

1. Luminaires up to 4 feet wide and 4 feet long: A minimum of four supporting points, one at each corner.
2. Luminaires 8 feet long: A minimum of five support points, one at center of luminaire and one at each corner.
3. Luminaires smaller than 2 feet in length: A minimum of two supporting points.

E. Provide pendant luminaires with swivel hangers which will allow luminaire to swing in any direction but will not permit stem to rotate.

1. Provide hangers with enclosure rating (NEMA 1, 4, or 7) equal to enclosure requirements of area in which they are installed.
2. Swivel hangers for luminaires in mechanical equipment areas: Shock absorbing type.
3. Secure low and high bay luminaires with safety chain or safety aircraft cable to the building structure.
    a. Chain or cable to prevent luminaire from falling more than 3 inches before the luminaire is caught by the chain or cable.

F. Pendant Mounted, Open, Industrial Luminaire:

1. Not in continuous rows:
    a. Supported by conduit or by approved chains or cable:
    b. Hardwired to ceiling mounted junction box.
2. In continuous rows:

a. Supported rigidly with conduit and fasten luminaire to each other or mount on continuous metal channel per Specification Section 26 05 00.
b. Hardwired to ceiling mounted junction box.
c. Provide reflector alignment clips.

G. Provide access panels for recessed luminaires that require access for maintenance when such access is not provided for in design of luminaire.

1. Locate luminaires in accordance with reflected ceiling plans.

H. Locate luminaire in exact center of ceiling tile unless otherwise indicated.

1. Relocate incorrectly installed luminaire and replace damaged ceiling materials.

I. Mount luminaire at heights indicated in Specification Section 26 05 00 or per Luminaire Schedule or as indicted on the Drawings.

J. Install exterior luminaires so that water cannot enter or accumulate in the wiring compartment.

K. Luminaires with Emergency Battery:

1. Where luminaires with emergency battery are shown controlled via switching device, connect the emergency battery to corresponding unswitched circuit so emergency battery will not operate when normal power is available and switching device turns lights off. Upon failure of normal power, luminaire will operate in emergency mode regardless of switch position.
2. Luminaire manufacturer to supply the emergency battery with luminaire.

L. Ground luminaire.

3.2 POLE INSTALLATION

A. Drawings Indicate the Intended Location of Light Pole:

1. Field conditions may affect actual location.
2. Coordinate location with all existing or new utilities and pavement.

B. Anchor Base Plated Poles:

1. Mounted on cast-in-place foundations, as detailed on the Drawings.
   a. Concrete and reinforcing steel, in accordance with Division 03 Specification Sections.
2. Protect pole finish during installation.
   a. Repair damage to pole finish with manufacturer approved repair kit.

C. Ground poles as indicated on the Drawings.

D. Conductors:

1. See Specification Section 26 05 19 for required underground conductors.
2. Use interior building wire, as specified in Specification Section 26 05 19, from pole base to luminaire, #12 AWG minimum.

E. Overcurrent and Short Circuit Protection:

1. Protect each phase with a UL Class CC fuse:
   a. Size: Three times load current.
   b. Standard: UL 248-4.
2. Fuseholder:
   a. Watertight, in-line and break-a-way style.
   b. Accept up to a 30 A, 600 V fuse.
   c. Neutral conductor shall utilize a fuseholder with a solid copper rod.
   d. Conductor terminal: Adequate size for the installed conductors.

3.3 LIGHTING CONTROL

A. See Specification Section 26 09 46 for lighting control equipment.

B. Exterior wall mounted and pole mounted fixtures controlled as detailed on the Drawings.

3.4 ADJUST AND CLEAN

A. See Specification Section 01 74 00.

B. Aim all emergency lighting units, so that, the path of egress is illuminated.

END OF SECTION

DIVISION 27

COMMUNICATIONS

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SECTION 27 05 01

COMMON WORK RESULTS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All labor, materials, tools, equipment, and services for Basic Materials and Methods for Communications Systems, as indicated, in accordance with provisions of Contract Documents to provide a full and operating communications system as described within Division 27 documents.

B. Related Requirements: Include but are not necessarily limited to:

1. Section 26 43 13 - Surge Protection Devices for Low-Voltage Electrical Power Circuits
2. Section 27 05 26 - Grounding and Bonding
3. Section 27 10 00 - Structured Cabling

1.2 REFERENCES

A. Reference Standards: Standards referenced in this section include, but are not necessarily limited to the following:

1. AMP NETCONNECT
   a. Design Installer Agreement (ND&I).
2. ASTM International:
   a. A36/A36M - Standard Specification for Carbon Structural Steel.
3. BICSI®
   a. Telecommunications Distribution Methods Manual (TDMM).
4. Code of Federal Regulations
   a. Title 47 – Telecommunication.
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE).
   a. C2 – National Electrical Safety Code (NESC).
6. ISO/IEC
   a. 11801 Generic Cabling for Customer Premises.
7. National Fire Protection Association® (NFPA)
   a. 70 – National Electrical Code (NEC).
8. TIA - Telecommunications Industry Association.
   a. 526 - Standard Test Procedures for Fiber Optic Systems.
   b. 526-7-A - Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant, Adoption of IEC 61280-4-2 edition 2: Fiber-Optic Communications Subsystem Test Procedures – Part 4-2: Installed Cable Plant – Single-Mode Attenuation and Optical Return Loss Measurement568.0 - Generic Telecommunications Cabling For Customer Premises.
   c. 568.1 - Commercial Building Telecommunications Infrastructure Standard.
   d. 568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard.
   e. 568.3 - Optical Fiber Cabling and Components Standard.
   f. 569 – Telecommunications Pathways and Spaces.
   g. 606 - Administration Standard for Telecommunications Infrastructure.
   h. 607 - Generic Telecommunications Bonding & Grounding (Earthing) for Customer Premises.

9. UL Solutions (UL).
    a. 1863 - UL Standard for Safety Communications-Circuit Accessories.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Build-out of all telecommunications areas, entrance facility, building distribution, floor distribution and data/telecommunication outlets meeting the requirements of TIA.
2. Adherence to the design guidelines for installation of cabling in pathways and spaces as defined by TIA 569
3. All material, labor, tool, apparatus, and equipment to furnish completely working telecommunication cabling system.
4. Horizontal cables, backbone cables, cross connects, patch cords and data/telecommunication outlets.
5. Complete bonding of all systems components and cabinets to the telecommunications primary busbar and secondary busbar(s) in compliance with TIA 607.
6. Cable identification tags and system labeling shall match owners labeling conventions.
7. Coordination of the entire installation with all other divisions.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers:
    a. Five continuous years, minimum, design and manufacture of the materials and equipment specified herein.
    b. Products and equipment specified herein shall demonstrate that they have a quality assurance program in place to assure that the specifications are met. Include in the program, at a minimum, provisions for:
        1) Incoming inspection of raw materials.
        2) In-process inspection and final inspection of the cable product.
        3) Calibration procedures of test equipment to be used in the qualifications of the product.
        4) Recall procedures in the event that out of calibration equipment is identified.
        5) Conform to government standards on quality assurance for applications within these specifications.
    c. Material and equipment shall be new, and conform to grade, quality, and standards specified. Equipment and materials of the same type shall be a product of the same manufacturer throughout.
    d. Equipment and materials of the type for which there are independent standard testing requirements, listings, and labels, shall be listed and labeled by the independent testing laboratory.
2. Installers:
    a. The intent of these specifications is to ensure the systems described in this division are provided and installed by a technically experienced installer and, further, that the work is fully coordinated between the various systems by a single installer who is technically qualified as described herein.
    b. Company specializing in installation of structured data/telecom cabling systems networks for a minimum of five years. Experience shall include the following:
        1) List at least 10 facilities of equal size, complexity and technical requirements utilizing the equipment submitted.
        2) For each facility, list:
            a) Name and location of facility.
            b) Date of occupancy by Owner.

c) Owner's representative to contact and telephone number.

d) Construction Manager or General Contractor.

e) Architect.

c. The successful cabling contractor must meet the following requirement:

1) Must have a BICSI® certified RCDD review the drawings and meet with the Engineer and Owner representatives to discuss the project and to ensure that a structured cabling system is installed that provides a comprehensive telecommunications infrastructure.

d. Where the installer is a branch office or other division of a larger organization, the qualifications of the branch office or other division shall meet the requirements of the Contract Documents. The installer incorporated under the same name, shall have successfully completed a minimum of three similar communications construction projects, both in scope and system types.

e. The work of this division shall be managed and supervised by a full-time site communications superintendent who shall have the following qualifications:

1) Experience in the applications engineering, installation, and supervision of similar construction projects both in scope and system type for a minimum of five years.

2) Full time employee of the installer.

3) Have a working knowledge of all systems installed under this division.

f. Project superintendent shall be on site full time through duration of construction.

1.5 SUBMITTALS

A. General:

1. Provide complete submittal package (shop drawings/product data) per individual Division 27 specification section. Information contained within each submittal package shall only pertain to the referenced specification section.
2. All submittal documents shall be submitted as pdf files. Drawings shall be produced on 30 inch x 42 inch format and product data shall be produced on 8.5 inch x 11 inch format.

B. Action Submittals: Submit the following:

1. Shop Drawings:
   a. General:
      1) Drawing comparison:
         a) Copy of drawing annotated where proposed system layout differs from designed system. Any differences to be explained.
   b. Equipment enclosure wiring diagrams:
      1) Show a pictorial illustration of each equipment enclosure and/or terminal cabinet.
      2) Show the device nomenclatures exactly as shown on the single-line diagrams.
      3) Show the terminations including the wire numbers as shown on the single-line diagrams.
      4) Show wire colors for each terminal.
      5) For each wire exiting the enclosure, show the destination of the wire by floor, room number and the drawing number of the panel where the wire terminates.
   c. Custom assembly diagrams:
      1) For each custom assembly such as a receptacle assembly, control panel or the like, provide an assembly drawing illustrating the appearance of the assembled device including dimensions, assembly components and functional attributes.
   d. Drawing comparison:
      1) Copy of drawing annotated where proposed system layout differs from designed system. Any differences to be explained.

C. Product Data:

1. Cover page: Each product shall have a cover page with the following information:
    a. Submitting Contractor’s Logo.
    b. Specification Section.
    c. Specification Reference.
    d. Manufacturer Name.
    e. Manufacturer Part Number.
    f. Brief Description.
2. Product Information: Include manufacturer's technical data, product literature, "catalog cuts", data sheets, specifications, and block wiring diagrams (if necessary) to clearly describe the product’s characteristics, physical and dimensional information, electrical performance data, materials used in fabrication, material color & finish, and other relevant information such as test data, typical usage examples, independent test agency information, and storage requirements. Clearly indicate by highlighting, arrows or brackets precisely what is being submitted on and those optional accessories, which are included and those which are excluded. At a minimum, include products listed in Division 27. Include relevant products that will be provided, which are not listed in the specifications.
    a. Do not include sheets that are not relevant to the product data or the project.
3. Specification comparison:
    a. Copy of specification annotated on a line-by-line basis where proposed product or system differs from specified product or system. Any differences to be explained.
4. Product list for Division 27 equipment per specified system.
5. Description of system operation indicating overall system operation and purpose and capabilities of each component within system.
6. Cross reference data sheets to components shown on shop drawings.
7. Samples:
    a. As indicated in each Division 27 section.
8. Testing Plans, Procedures, and Testing Limitations:
        1) Testing procedure, apparatus, and limitations of apparatus and procedure, for:
            a) Source quality control activities indicated in each Division 27 section.
            b) Field quality control activities indicated in each Division 27 section.

D. Informational Submittals: Submit the following:

1. Certificates.
2. Manufacturer Instructions:
    a. Serial numbers of items furnished, equipment nameplate information, and similar information for all items furnished.
    b. Instructions for handling, installation, startup.

E. Qualifications Statements:

1. Manufacturer.
2. Installer.

F. Contract closeout information:
1. As indicated in each Division 27 section.
2. Operation and Maintenance Data

G. Maintenance Material Submittals: Furnish the items and submit documentation of delivery to and acceptance of such items by Owner or facility manager (as applicable) as defined in each Division 27 section.

1.6 WARRANTY

A. Manufacturer's Special or Extended Warranty:

1. In addition to manufacturer's general, standard printed warranty, furnish any manufacturer's special warranty coverage. Special warranty shall remain in effect as indicated commencing on the date of Substantial Completion for the associated Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:

1. As noted in each Division 27 section.

B. Use UL labeled electrical materials where listing has been established for materials or devices in question.

C. Structural steel for supports: ASTM-A36/A36M.

1. Stainless steel members installed in all corrosive areas, including locations less than 10 miles from a saltwater source.
2. Galvanize members installed in areas of high humidity or condensation.
3. Furnish other members with shop coat of rust inhibiting primer.
4. Shop fabricate for field assembly using bolts.
5. Minimize field welding.
6. Retouch primer and galvanizing after field welding.

2.2 EXTRA MATERIALS

A. Furnish spare parts required in each Division 27 section.

B. All spare parts shall be new and in original packaging from manufacturer.

C. Ensure parts are packaged to protect from damage and to allow for easy storage.

D. Provide inventory of all spare parts.

2.3 EQUIPMENT ENCLOSURE RATING

A. Use equipment enclosures suitable for the environment.

PART 3 - EXECUTION

3.1 INSTALLATION OF COMMUNICATIONS INFRASTRUCTURE

A. Provide access panels in any area where equipment is located which requires accessibility for service and/or maintenance.

B. Do not change indicated sizes or configuration without written approval of Architect/Engineer.

C. Conduit verification:

1. Verify that all conduit is clear of foreign matter and substances prior to pulling of wire or cable.
2. Apply a chemically inert conduit lubricant to all wire and cable prior to pulling. Do not subject wire and cable to tension greater than recommended by the manufacturer. Under no circumstances shall wire or cable be attached to any mechanical pulling device which exerts excessive force, shear or tensile.
3. Secure all wire and cable runs vertically in conduit for continuous distances greater than thirty (30) feet at the vertical run terminations. Non-coaxial cables shall be secured by screw-flange nylon cable ties or similar devices. Symmetrical clamping devices with split, circular or other wire conforming, non-metallic bushings shall be provided for all other cables.

D. Structured cabling systems shall not occupy the same conduit/raceway with any other system or power cables.

E. Provide installation, including electrical connections, cable pulling, testing and interfacing of systems.

F. Deliver materials and equipment to project and store in original containers or cartons, properly protected from elements.

G. Execute all work described in this specification and shown on drawings and all work dependent upon, and necessary to, complete finish of the work so described or shown, in a skillful manner using materials best adapted to purposes where such work or material is not specifically mentioned.

H. Labeling:

1. All labeling shall be in accordance with TIA-606-D requirements and Owner's labeling convention.

3.2 INSTALLATION OF EQUIPMENT

A. Install all equipment and infrastructure in accord with manufacturer's recommendations.

B. Provide all necessary anchoring devices and supports.

1. Use structural supports suitable for equipment.
2. Check loadings and dimensions of equipment with shop drawings.
3. Do not cut, or weld to, building structural members.

C. Verify that equipment will fit support layouts indicated.

1. Where substitute equipment is used, revise indicated supports to fit at no additional expense.

D. Arrange for necessary openings to allow entry of equipment.

1. Where equipment cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves or other devices to allow later installation.

E. Installation of communications equipment shall not proceed until the progress of construction has reached the following status in the area of installation:

1. Temperature and humidity are controlled.
2. Finished ceiling is installed.
3. Walls are finish coated with final paint treatment.
4. Floors are finished and sealed.
5. Millwork is completely installed, approved and signed off.

F. Equipment installed in areas where the previously described conditions have not been met and maintained after equipment installation shall be removed and either cleaned or replaced at the Architect/Engineer's discretion.

G. Install equipment to permit easy access for normal maintenance.

1. Maintain easy access to switches, pull boxes, panels, receptacles, etc.
2. Relocate items which interfere with access.

3.3 CUTTING AND PATCHING

A. Refer to section 01 73 29 - Cutting and Patching.

3.4 COORDINATION

A. General:

1. Coordinate the work with the other trades to assure that where this work interfaces to other trades, those interfaces are provided, complete and functional.

2. Verify all field conditions.
3. Positioning Members: Provide additional support or positioning members as required for the proper installation and operation of equipment, materials and devices provided as part of this work as approved by the Architect or Owner without additional expense.
4. Interface Devices: Provide all items necessary to complete this work in conformance with the Contract Documents or the satisfaction of the Owner without any additional expense.

3.5 FINISHES (SEE DIVISION 09)

3.6 WIRING

A. All cable and wire:

1. Standard type available from more than one cable manufacturer.
2. Manufacturer and installer are responsible for system performance.

B. All cabling, wiring, conduits/raceways and equipment housings: In strict accordance with recommendations of equipment manufacturer; finish and color of all face plates as directed by Architect/Engineer.

C. Furnish and install all wiring and cable for communications systems and perform all connections and equipment terminations.

1. Check each cabling system run thoroughly for opens, shorts, faults, and other discontinuities.
2. Test each system receptacle for continuity, ground condition, and voltage level prior to allowing plug-in of system equipment.
3. All conductors from outgoing terminal blocks in control consoles, panels and/or systems equipment cabinets to devices controlled to be continuous.
    a. No splicing of cabling allowed.
4. Field device terminations to be per manufacturer's requirements.
    a. Conductor to conductor connections to be fully insulated crimp on male/female tab type or pin and sleeve type.
    b. No conical spring connectors to be used.

D. Install communications systems cable in conduit 1 inch minimum, unless otherwise indicated.

E. Boxes: Provide a 6-inch loop for all wire and cable routed through pull boxes or distribution panels. Cable loops and bends shall not be at a radius smaller than that recommended by the manufacturer. Enlarge pull boxes as necessary to accommodate this requirement.

3.7 FIELD QUALITY CONTROL

A. Perform indicated tests to demonstrate workmanship, operation, and performance.

1. Conduct tests in presence of Architect/Engineer, Owner and, if required inspectors of agencies having jurisdiction.
2. Arrange date of tests in advance with Architect/Engineer, manufacturer and installer.
3. Give minimum of 1 week notice to all inspectors.
4. Furnish or arrange for use of electrical energy, steam, water, diesel fuel, or gas required for tests.

B. Repair or replace equipment and systems found inoperative or defective and retest.

1. If equipment or system fails retest, replace it with products conforming to Contract Documents.
2. Continue remedial measures and retests until satisfactory results are obtained.

C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

3.8 SYSTEMS OPERATIONAL TESTS

A. Prior to the time of substantial completion, an operational test, witnessed by a representative of the Architect/Engineer and Owner, shall be held of each system comprising the total communications systems to determine full compliance with the contract drawings. Provide all personnel, equipment, instrumentation, and communication equipment and include all costs of testing in the contract.

B. The installer shall certify in writing that the systems are installed in compliance with the manufacturer's recommendations, Refer to the requirements of the contract documents and are operating correctly. These written certifications shall be submitted to the Architect/Engineer and shall signify that the total communications system is operationally tested and ready for final acceptance testing by the Architect/Engineer.

C. Final acceptance tests of the total communications systems shall be conducted as directed by the Architect/Engineer.

D. It shall be the responsibility of the Installer to submit for the Architect/Engineer's approval, a proposed systems check list for use in final acceptance testing. This checklist shall consist of a list of individual tasks on a device-by-device basis, organized into logical groups per system being supplied. The checklist shall be submitted not later than 90 days prior to the scheduled start of acceptance testing. Acceptance testing may not begin until the Architect/Engineer has approved the form and content of the acceptance checklist.

3.9 ADJUST AND CLEAN

A. Inspect all equipment and put in good working order.

B. Clean all exposed and concealed items.

C. All equipment shall be clean and dust free.

3.10 PUTTING SYSTEMS IN OPERATION - START UP

A. All systems shall be in satisfactory operation prior to final acceptance, at time agreed to by Owner and Architect/Engineer.

B. Operate all systems in good working order for period of 10 working days prior to final acceptance testing.

3.11 DEVICE MOUNTING

A. Dimensions are to center of device unless otherwise indicated.

END OF SECTION

SECTION 27 10 00
STRUCTURED CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Material and installation requirements for the structural cabling system such as:
   a. Service entrance protection.
   b. Cabinets, racks, frames, and enclosures.
   c. Termination blocks and patch panels.
   d. Cable management.
   e. Rack mounted power protection and power strips.
   f. Backbone cabling.
   g. Horizontal cabling.
   h. Patch cords.

B. Related Sections include but are not necessarily limited to:

1. Section 27 05 01 – Basic Materials and Methods for Communications Systems.
2. Section 27 05 26 - Grounding and Bonding.

1.2 REFERENCES

A. Reference Standards: Standards referenced in this section include, but are not necessarily limited to the following:

1. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
2. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
   a. TIA 526-7 – Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
   b. TIA 526-14-C – Optical Power Loss Measurement of Installed Multimode Fiber Cable Plant.
   c. TIA 568-0-E – Generic Telecommunications Cabling for Customer Premises.
   d. TIA 568-1-E – Commercial Building Telecommunications Cabling Standard Part 1: General Requirements.
   e. TIA 568-2-D – Balanced Twisted-Pair Telecommunications Cabling and Components Standards.
   f. TIA 568-3-D – Optical Fiber Cabling Components Standard.
   g. TIA 569-E – Telecommunications Pathways and Spaces.
   h. TIA-606-D Administration Standard for the Telecommunications Infrastructure.
   i. TIA/EIA 604-2 – FOCIS 2 Fiber Optic Connector Intermateability Standard, Type ST.
   j. TIA/EIA 604-3 – FOCIS 3 Fiber Optic Connector Intermateability Standard, Type SC and SC-APC.
   k. TIA/EIA 604-10 – FOCIS 10 Fiber Optic Connector Intermateability Standard, Type LC.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers:

a. See Specification Section 27 05 01 for additional requirements.

2. Installers:
   a. Comply with TIA-569E Standard and the BICSI Telecommunications Distribution Methods Manual (TDMM) for the installation of Communication cabling.
   b. See Specification Section 27 05 01 for additional requirements.

B. Qualifications:

1. Telecommunications Contractor:
   a. Shall be regularly and professionally engaged in the business of the applications, installation, and testing of telecommunications systems and equipment.
   b. Include three references of similar scope jobs completed in the last two years.
   c. Supervisors and Installers shall be Building Industry Consulting Services International (BICSI) Registered Cabling Installers, Technician Level.
   d. In lieu of BICSI Certification, Supervisors and Installers assigned to the installation of this system or any of its components shall have:
      1) A minimum of five years of experience in the installation of the specified copper and fiber optic cable and components.
      2) Factory or factory approved certification from each equipment manufacturer indicating that they are qualified to install and test the provided products.
2. Manufacturer:
   a. Company specializing in manufacturing products specified in this Section with minimum 10 years documented experience in the manufacturing, assembly, and factory testing of components which comply with TIA-568-1-E, TIA-568-2-D, and TIA-568-3-D.

1.4 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Fabrication and/or layout drawings, sealed and approved by a Registered Communications Distribution Designer (RCDD):
      1) Layout of complete building per floor:
         a) Building area boundaries, backbone systems and horizontal pathways.
      2) Building area drawings:
         a) Drop locations and cable identifications in accordance with TIA-606-D.
      3) Telecommunications space drawings:
         a) Telecommunication rooms plan views, pathway layout, mechanical/electrical layout, and cabinet, rack, backboard, and wall elevations.
      4) Typical detail drawings:
         a) Faceplate labeling, faceplate types, and firestopping.
2. Product Data:
   a. Submittal data for all products specified in PART 2 of this Specification.
   b. See Specification Section 27 05 01 for additional requirements.

B. Informational Submittals: Submit the following:

1. Certificates:
   a. Telecommunications Contractor and Installers qualifications.
   b. Key Personnel qualifications.
   c. Manufacturer qualifications.
2. Test reports:
   a. Testing plan and procedures.
   b. Telecommunications cabling test results for all horizontal and backbone links.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Specification Section 27 05 01 for additional requirements.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. All Materials and equipment shall be:

1. Appropriate for the intended use.
2. Recognized as such by a Nationally Recognized Testing Laboratory (NRTL) such as Underwriters Laboratories (UL), ETL SEMCO (ETL), the Canadian Standards Association (CSA) or the American National Standards Institute (ANSI).
3. NFPA 70 Compliant.
4. Permitted by the Authority Having Jurisdiction (AHJ).

B. All products shall be new, of the latest version at time of bid, and brought to the job site in original manufacturer's packaging. Used equipment and damaged materials will be rejected.

C. Cable lubricants specifically designed for installing communications cable may be used as needed to reduce pulling tension when pulling cable into conduit.

D. All copper products shall be from a single manufacturer so that a single performance warranty covers all applications on horizontal links/channel.

E. See Specification Section 27 05 01 for additional requirements.

2.2 SUBSTITUTION POLICY

A. This specification design is based on Panduit Copper Cable. As such, substitution of specified products must be submitted to, and approved by, Engineer of Record (EOR). Any substitutions shall meet or exceed performance specified.

2.3 COMMUNICATION CABINETS

A. Panduit PanZone True Edge Vertical wall mount enclosure.

1. Size as required for cable terminations required for the project..
2. Low profile front accessible..

2.4 COPPER PATCH PANELS

A. Patch panels mounted in equipment racks with sufficient ports to accommodate all installed cable plus 25% spare:

1. Copper IDC Punchdown Patch Panel:
   a. 48-port modular jack (2U maximum) and 24-port modular jack (1U maximum), with rear mounted type 110 insulation displacement connectors.
   b. Panel shall have incoming cable strain relief and cable management guides.
   c. Jack pin/pair configuration shall be T568B.
   d. Jacks shall be unkeyed.
   e. Flat Patch Panels:
      1) Category 6, 24 Port 1U Flat: PANDUIT – DP24688TGY or equal.

2.5 FIBER OPTIC ENCLOSURES

A. Manufacturers:

1. Corning is Basis of Design.
2. Acceptable Alternates to match Copper Connectivity Manufacturer:
   a. Belden.
   b. Panduit.

c. Siemon.
d. Systimax.

2.6 TERMINATION BLOCKS

A. Terminal blocks:

1. Wall mounted or rack mounted wire termination units consisting of insulation displacement connectors mounted in plastic blocks, frames, or housings.
   a. Blocks shall be type 110 which meet the requirements for Category 6 or as shown.
2. Blocks shall be mounted on standoffs and shall include cable management hardware.
3. Provide space for the number of horizontal and backbone cables terminated on the blocks plus 25% spare.

2.7 BACKBONE CABLING SYSTEM

2.8 HORIZONTAL UTP CABLING

A. Category 6 Unshielded Twisted Pair Cable – All Work Areas.

1. Panduit TX6 Category 6 UTP Copper Cable.
2. In addition, Category 6 UTP Copper Cable must meet the following mechanical and performance criteria:
   a. Exceeds requirements for TIA-562.2-D Category 6 and ISO 11801 2nd Edition Class E channel standards.
   b. Exceeds requirements of TIA-568.2-D and IEC 61156-5 Category 6 component standards.
   c. Meets requirements of IEEE 802.3af, IEEE 802.at and IEEE 802.bt for PoE applications.
   d. Third party tested to comply with TIA-568.2-D.
   e. Installation temperature range: 32 to 122 degrees F (0 to 50 degrees C).
   f. Operating temperature range: -4 to 194 degrees F (-20 to 90 degrees C).
   g. Cable shall be UL listed “LP” Limited Power for 0.05A. – LP (0.5A) shall be identified on the cable.
3. Environmental Space:
   a. Plenum (CMP), Diameter .224 inches (6.2mm) nominal.
   b. Non-Plenum (CMR), Diameter .210 inches (5.3mm) nominal.
4. Cable Color:
   a. Work Area Outlet Data/Voice – Blue.

2.9 TELECOMMUNICATIONS OUTLETS

A. Faceplates.

1. Faceplates shall have the following attributes:
   a. Be single-gang or double-gang.
   b. Made by the same manufacturer as the jacks.
   c. Supplied in colors and finishes coordinated with the [Division 26 27 26 Wiring Devices].
   d. Have the capability for integral labeling and identification.
   e. Provide capacity for a maximum of:
      1) Six individual jacks for single-gang applications.
      2) Up to 12 individual jacks for double-gang applications.
2. Manufacturer:
   a. Panduit CFPL2**Y Classic Faceplate, Single Gang with Label, 2-port.
   b. Panduit CFPL4**Y Classic Faceplate, Single Gang with Label, 4-port.

c. Panduit KWPY Wall Phone Plate, Single Gang.

B. Copper Jacks.

1. Category 6 UTP Jacks.
   a. Install category 6 jacks at each workstation location and match in the TR at the patch panel.
   b. Category 6 jacks at the work area shall be color:
      1) PANDUIT – CJ688TGBU (Work Area Outlet Data/Voice – Blue).
   c. In addition, Category 6 Copper Jacks must meet the following mechanical and performance criteria:
      1) Exceed TIA-568.2-D Category 6 and ISO 11801 2nd Edition Class EA standards.
      2) Meets requirements of IEEE 802.3af, IEEE 802.3at and IEEE 802.3bt for PoE applications.
      3) Be 100% tested to ensure NEXT and RL performance and be individually serialized for traceability.
      4) Color-coded, keyed jack modules mechanically and visually distinguish connections to prevent unintentional mating with unlike keyed or non-keyed modular plugs accommodating more discrete networks.
      5) Utilize patented enhanced Giga-TX ™Technology for jack terminations which optimizes performance by maintaining cable pair geometry and eliminating conductor untwist.
      6) Have contacts plated with 50 micro inches of gold for superior performance.
      7) 3rd party certified to meet the mechanical endurance to the standard requirement of IEC 60512-99-001 for support of remote power applications with test current of 2 Amperes per conductor (for future PoE++ applications).
      8) Have guaranteed ability to be re-terminated a minimum of twenty times without measurable degradation of performance.
      9) Have range to terminate 4-pair, 22 – 26 AWG, 100 Ohm, solid or stranded twisted pair cable.
      10) Accept 6 and 8-position modular plugs without damage to conductor pins.
      11) Identified options that include optional labels and icons.
      12) Be compatible with Mini-Com ® Modular Patch Panels, Faceplates, and Surface Mount Boxes.
      13) Have available optional RJ45 block-out device that blocks out unauthorized access to jack modules and potentially harmful foreign objects, saving time and money associated with data security breaches, network downtime, repair, and hardware replacement.

2.10 PATCH CORDS

A. Supply patch cords equal to 1.1 times the number of cables terminated in the communication room(s).

1. Provide for installed copper and fiber-optic systems.
2. Length: As required for connection without strain and ability to service equipment.

B. Patch Cords, Copper:

1. Assemblies consisting of flexible, twisted pair stranded wire with eight-position plugs at each end.
2. Cable shall be label-verified.
3. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
4. Patch cords shall be wired straight through; pin numbers shall be identical at each end and shall be paired to match T568B patch panel jack wiring.

5. Patch cords shall be unkeyed.
6. Patch cords shall be factory assembled.
7. Patch cords shall match the color of the installed system.

C. Patch Cords, Single Mode Fiber:

1. Assemblies consisting of flexible, 9um/125µm OS2 rated cable with duplex LC connectors at each end.
2. Cable shall be label-verified.
3. Cable jacket shall be factory marked at regular intervals indicating verifying organization and performance level.
4. Patch cords shall have crossover orientation.
5. Patch cords shall be unkeyed.
6. Patch cords shall be factory assembled.
7. Patch cords shall be yellow.

2.11 LABELING AND COLOR CODING

A. Labels shall be developed by the contractor and approved by the Owner.

1. Labels shall be machine printed on opaque or clear tape, stenciled onto adhesive labels.
2. Handwritten labeling is unacceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. System components and appurtenances shall be installed in accordance with NFPA 70, manufacturer's instructions and as shown.

B. Necessary interconnections, services, and adjustments required for a complete and operable signal distribution system shall be coordinated with the local communications provider(s).

C. Components shall be labeled in accordance with TIA 606-D.

D. Penetrations in fire-rated construction shall be firestopped.

E. Wiring shall be installed in accordance with TIA/EIA/ANSI Standards.

1. Wiring, and terminal blocks and outlets shall be marked in accordance with TIA 606-D.

F. Cables shall not be installed in the same cable tray, utility pole compartment, or floor trench compartment with AC power cables.

G. Terminal Blocks:

1. Terminal blocks shall be mounted in orderly rows and columns.
2. Adequate vertical and horizontal wire routing areas shall be provided between groups of blocks.
3. Industry standard wire routing guides shall be utilized.

H. Pathway System:

1. Provide in accordance with TIA 569-E and NFPA 70.
2. Provide bonding of raceways and cable tray in accordance with TIA 607-D and NFPA 70.

I. Unshielded Twisted Pair Patch Panels:

1. Patch panels shall be mounted in equipment racks with sufficient modular jacks to accommodate the installed cable plant plus 25% spares.
2. Cable guides shall be provided above, below and between each panel.

J. Backbone and Horizontal Distribution Cable:

1. Cable pulling tension shall not be exceeded.
    a. 110N (25 pounds-force) for copper cabling.
2. Cable shall not be stressed such that twisting, stretching, or kinking occurs.
3. Cable shall not be spliced.
4. All backbone cable shall be installed in conduit or cable tray.
5. All horizontal cable shall be installed in an appropriate telecommunications pathway.
6. Cable shall not be run through structural members or in contact with conduits, pipes, ducts, or other potentially damaging items.
7. Placement of cable parallel to power conductors shall be avoided, if possible; a minimum separation of 12 inches shall be maintained when such placement cannot be avoided.
8. Cables shall be terminated; no cable shall contain unterminated elements.
9. Minimum bending radius shall not be exceeded during installation or once installed.
10. Only fabric hook and loop fasteners shall be used to wrap cables, 1/2 inches width minimum. Plastic or nylon cable ties shall not be used.

K. Telecommunications Outlets:

1. Faceplates: As a minimum each jack shall be labeled as to its function and a unique number to identify cable link.
2. Cables:
    a. Unshielded twisted pair cables shall have a minimum of 12 inches of slack cable loosely coiled into the telecommunications outlet boxes.
    b. Minimum manufacturers bend radius for each type of cable shall not be exceeded.

3.2 TERMINATION

A. Cables and conductors shall sweep into termination areas; cables and conductors shall not bend at right angles.

1. Manufacturer's minimum bending radius shall not be exceeded.
2. When there are multiple system type drops to individual workstations, relative position for each system shall be maintained on each system termination block or patch panel.
3. Unshielded Twisted Pair Cable:
    a. Each pair shall be terminated on appropriate outlets, terminal blocks, or patch panels.
    b. No cable shall be unterminated or contain unterminated elements.
    c. Pairs shall remain twisted together to within the proper distance from the termination as specified in the TIA/EIA/ANSI 568B Series.
    d. Conductors shall not be damaged when removing insulation.
    e. Wire insulation shall not be damaged when removing outer jacket.
4. Fiber Optic Cable:
    a. Each pair shall be terminated with appropriate connectors.
    b. No cable shall be unterminated or contain unterminated elements.

3.3 GROUNDING

A. Signal distribution system ground shall be installed in the telecommunications entrance facility and in each telecommunication closet in accordance with TIA607-D.

1. Equipment racks shall be connected to the electrical safety ground.

3.4 LABELING

A. All cables will be labeled using color labels on both ends per TIA 606-D.

B. All workstation and patch panel connections will be labeled using color coded labels per TIA 606-D.

3.5 TESTING

A. Testing shall conform to the TIA/ANSI Standards for all test parameters.

1. All test data sheets shall be downloaded from the tester, printed out and provided to the Owner.
2. Provide Owner with all test results as Electronic Documents (in portable document format, PDF files) by Electronic Means [in accordance with Section 01 31 26 – Electronic Communication Protocols].
3. Tester shall be capable of testing parameters for the warranted system.

B. Materials and documentation to be furnished under this Specification are subject to inspections and tests.

1. All components shall be terminated prior to testing.
2. Equipment and systems will not be accepted until the required inspections and tests have been made, demonstrating that the signal distribution system conforms to the specified requirements, and that the required equipment, systems, and documentation have been provided.

C. Unshielded Twisted Pair Tests:

1. All metallic cable pairs shall be tested for proper identification and continuity.
2. All opens, shorts, crosses, grounds, and reversals shall be corrected.
3. Correct color coding and termination of each pair shall be verified in the communications closet and at the outlet.
4. Horizontal wiring shall be tested from and including the termination device in the communications closet to and including the modular jack in each room.
5. These tests shall be completed, and all errors corrected before any other tests are started.

D. Category 6 Circuits:

1. Perform Category 6 link tests in accordance with TIA-568-1-E and TIA-568-2-D. Tests shall include wire map, length, insertion loss, NEXT, PSNEXT, ELFEXT, PSELFEXT, return loss, propagation delay, and delay skew.
2. Cables which contain failed circuits shall be replaced and retested to verify the standard is met.

DIVISION 31

EARTHWORK

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SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Site clearing Work, including:
   a. General provisions for site clearing Work.
   b. Preparation for site clearing Work.
   c. Clearing and grubbing.
   d. Disposal and cleaning.
   e. Stripping and stockpiling of topsoil.

B. Related Requirements: Include but are not necessarily limited to:

1.2 REFERENCES

A. Terminology:

1. Terms indicated below are not defined terms indicated with initial capital letters but, when used in this Section, have the meanings indicated below:
   a. “Clearing and grubbing” means removing and disposing of all: (1) trees, brush, and other vegetation, logs, and similar items (“clearing”); and (2) stumps, roots, logs, rubbish, and debris on or in the soil (“grubbing”) after Clearing. Clearing and grubbing includes grinding and removing of stumps. When clearing and grubbing, topsoil stripping and stockpiling is complete, the Site will be ready for grading and other new construction.
   b. “Demolition” means removal, whether in whole or in part, of existing human-made construction, such as removal of buildings, structures, and building systems; site work (such as pavement, curbs, sidewalks, gutters) and the like; Underground Facilities; and other existing construction.
   c. “Selective removal” means removal of specific trees, shrubs, brush, and other vegetation, whether as shown or indicated in the Contract Documents or as directed at the Site by Engineer.
   d. “Site clearing” means all the Work required by this Section and related Drawings.
   e. “Topsoil” means existing material at the Site, visible after clearing and grubbing, to be stripped, when such material is friable, clay loam, surface soil present in depth of not less than four inches. Topsoil shall be free of subsoil, clay lumps, stones, and other objects over two-inch diameter and other objectionable material. Topsoil required for planting and landscaping Work in the Specifications of Division 32 may differ from the meaning indicated in this Section.

B. Reference Standards:

1. ASTM International (ASTM):
   a. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
   b. D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

1.3 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Limits of Site Clearing Work: When limits of site clearing Work are not expressly shown on the Drawings, or where Contractor proposes alternative limits of site clearing Work,

submit drawings, developed from the Drawings, clearly indicating proposed limits of site clearing Work, with dimensions indicated where appropriate.

b. Where proposed limits of clearing and grubbing, selective removals, and topsoil stripping are not identical with each other, clearly and expressly indicate limits of each on the Shop Drawings. .

B. Informational Submittals: Submit the following:

1. Approvals:

a. Where Owner's permission or approval is required for selected site clearing activities (if different from drawings), submit copy of Owner's written permission or approval for such activity.

PART 2 - EXECUTION

2.1 SITE CLEARING – GENERAL

A. Limits of Site Clearing Work:

1. Limits of site clearing Work are shown and indicated on the Drawings.

B. General Provisions for Site Clearing:

1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals necessary and required to perform site clearing Work in accordance with the Contract Documents.
2. Perform site clearing Work to avoid creating nuisances, pollution, and preventable adverse effects on the environment.
3. All work must stat within property limits and not cause runoff from property
4. Requirements of Authorities Having Jurisdiction:
   a. Perform site clearing Work in accordance with Laws and Regulations.
5. Traffic Control:
   a. Establish such controls prior to and maintain in place throughout site clearing Work that has potential to affect traffic.
6. Site clearing Work shall comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article, unless the Contract Documents indicate more-stringent requirements.

2.2 PREPARATION

A. Approvals:

1. Do not commence site clearing Work until necessary approvals are obtained and copies furnished to Engineer as Submittals.

B. Delineation of Limits of Site Clearing Work Areas:

1. Locate and clearly flag at the Site:
   a. Limits of site clearing Work.
   b. Vegetation, aggregate, and other materials to remain within limits of site clearing Work.
   c. Vegetation to be selectively removed.
   d. Salvageable vegetation (to be relocated) or aggregate within limits of site clearing Work.
2. Flagging:
   a. Flagging shall be high-visibility type. Where necessary, provide lath or stakes driven into the ground, with flagging, to clearly delineate limits.
   b. Provide different-colored flagging for each type of delineation required by this Article.
   c. Promptly replace lost, moved, or destroyed flagging until Engineer concurs that flagging is no longer needed.

3. Review with Engineer:
    a. Before starting site clearing Work, other than flagging, review at the Site with Engineer.
    b. Make corrections as necessary.

C. Temporary Erosion and Sediment Controls:

1. Provide applicable temporary erosion and sediment controls before commencing clearing and grubbing and topsoil stripping Work.
2. Continue providing temporary erosion and sediment controls as clearing and grubbing and topsoil stripping and stockpiling Work progresses into previously uncleared, ungrubbed areas of the Site.

2.3 CLEARING AND GRUBBING

A. Clearing and Grubbing – General:

1. Remove and dispose of all materials constituting clearing and grubbing Work within limits shown and indicated in the Contract Documents.
2. After grubbing Work is complete, properly fill holes resulting from grubbing before commencing site grading Work.

2.4 DISPOSAL AND CLEANING

A. Disposal – General:

1. Dispose of matter resulting from clearing and grubbing, selective removals, and selective trimming, at appropriate offsite location, unless otherwise expressly allowed by the Contract Documents or mutual agreement of Owner and Contractor.
2. Do not use cleared, grubbed, or trimmed material as fill, backfill, or in embankments.
3. Dispose of cleared, grubbed, and trimmed material, and other materials, rubbish, and debris, in accordance with Laws and Regulations.
4. Pay all costs associated with transporting and disposing of materials and debris resulting from site clearing Work.

2.5 TOPSOIL STRIPPING AND STOCKPILING

A. Stripping:

1. Before commencing topsoil stripping:
    a. Perform clearing and grubbing and selective removals.
    b. Remove grass and other vegetation that may remain following clearing and grubbing.
    c. Provide necessary and required temporary erosion and sediment controls.
2. Strip topsoil to depths encountered, in manner that prevents intermingling of topsoil with underlying subsoil and other objectionable material. Remove heavy growths of grass and vegetation and material below topsoil.
3. Before stockpiling, separate objectionable material from topsoil.

B. Stockpiling:

1. Construct and maintain topsoil stockpiles in at locations agreed upon with Project Owner – near South soil borrow area.

C. Reuse of Stripped Topsoil:

1. Reuse in the finish grading and landscaping Work topsoil that complies with the Contract Documents for such Work.
2. Where topsoil stripped from the Site does not comply with the Contract Documents relative to quality required for use in finish grading and landscaping Work, provide appropriate soil amendment material, properly and fully mixed into topsoil stripped from the Site, so that amended material complies with quality requirements for topsoil required for finish grading and landscaping Work.

D. Disposal of Excess Topsoil:

1. Topsoil in excess of quantity required for finished Project becomes Owner's property when Engineer indicates finish grading and landscaping Work is complete.

END OF SECTION

SECTION 31 23 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Earthwork - excavation, backfilling, grading, compaction, disposal of waste and surplus materials, placing crushed stone, construction of berms, sheeting, bracing, dewatering and other Earthwork related work.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 07 26 00 - Under Slab Vapor Retarder.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. ASTM International (ASTM):
   a. C33/C33M, Standard Specification for Concrete Aggregates.
   b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/FT^3).
   c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 feet-LBF/FT^3(2,700 kN-M/M^3)).
   d. D1586, Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
   e. D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   f. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
   g. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   h. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   i. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
2. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR Part 1926.650, Safety and Health Regulations for Construction - Excavations, referred to herein as OSHA Standards.

1.3 DEFINITIONS

A. Excavation:

1. Consists of removal of material encountered to subgrade elevations required or indicated.
2. Includes excavation of soils; pavements and other obstructions visible on surface; underground structures, utilities, and other items indicated to be demolished and removed; boulders; and rock.

B. Foundations: Footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil or rock.

C. Geotechnical Engineer: Independent geotechnical specialist providing field quality control for the project.

D. Non-Structural Fill/Backfill: Soil materials placed and compacted to achieve finish grade elevations that do NOT support foundations, slabs, paving, or other flatwork.

E. Structure: Buildings, foundations, slabs, tanks, curbs, or other man-made stationary features occurring above or below ground surface.

F. Subgrade: The earth or soil layer immediately below foundation bearing elevation, subbase material, fill material, backfill material, or topsoil materials.

G. Unauthorized Excavation:

1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer.
    a. Unauthorized excavation, as well as associated remedial work as directed by Engineer or Geotechnical Engineer, shall be at Contractor’s expense.
2. Unsuitable Soil Materials: Soil materials encountered at or below subgrade elevation of insufficient strength and stiffness to support construction as determined by the Geotechnical Engineer.

1.4 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
2. Certifications.

B. Samples:

1. Coordinate samples and testing for approval of off-site materials with the Geotechnical Engineer.
2. Test reports.

1.5 PROJECT CONDITIONS

A. .Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.

B. Dispose of waste materials, legally, off site.

1. Burning, as a means of waste disposal, is not permitted.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Fill and Backfill:

1. Selected material approved by Geotechnical Engineer from site excavation or from off site borrow.
2. Structural Fill:
    a. May be low volume change cohesive or granular soil at Contractor’s option.
    b. Free of organic matter, frozen material and debris.
    c. Low volume change cohesive soil:
        1) ASTM D2487 classification: CL.
        2) Liquid limit: Less than 45.
        3) Maximum plasticity index: 20.
    d. Granular soil:
        1) ASTM D2487 classification: GW, GP, GM, GC, SW, SP, SM or SC.
3. Non-Structural Fill:
    a. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL.
    b. Liquid limit: Less than 45.

c. Maximum plasticity index: 20.

B. Granular Fill Under Building Floor Slabs-On-Grade:

1. Clean, granular material.
2. Less than 5% fines passing the No. 200 sieve.
3. ASTM C33/C33M gradation size No. 67, 3/4 inches to No. 4 or other material acceptable to Geotechnical Engineer.

C. Granular Fill Under Electrical Equipment Pads, Manholes and Handholes: Clean, crushed, nonporous rock, crushed or uncrushed gravel complying with ASTM C33/C33M gradation size No. 67, 3/4 inches to No. 4.

D. Geotextile Filter Fabric:

1. Nonwoven type.
2. Equivalent opening size: 50 - 100 (U.S. Standard Sieve).
3. Permeability coefficient (cm/second): 0.07 minimum, 0.30 maximum.
4. Grab strength: 90 pounds minimum in either direction in accordance with ASTM D4632 requirements.
5. Mullen burst strength: 125 psi minimum in accordance with ASTM D3786 requirements.

E. Vapor Retarder: Refer to Specification Section 07 26 00.

PART 3 - EXECUTION

3.1 PROTECTION

A. Erosion Control:

1. Clean paved roadways daily of any spillage of dirt, rocks or debris from vehicles and equipment entering or leaving site.
2. Install silt fence around entire project area and maintain for duration of the project.
3. Conduct work to minimize erosion of site. Remove eroded material washed off site.
   a. If necessary or requested by Engineer, construct stilling areas to settle and detain eroded material.

B. Protect existing surface and subsurface features on-site and adjacent to site as follows:

1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
2. Protect and maintain benchmarks, monuments or other established reference points and property corners.
   a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
3. Verify location of utilities.
   a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
   b. Secure and examine local utility records for location data.
   c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
      1) If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
      2) Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Owner and then only after acceptable temporary utility services have been provided.
      3) Obtain Owner’s approval prior to disconnecting any utility service.
   d. Repair damages to utility items at own expense.

e. In case of damage, notify Engineer at once so required protective measures may be taken.

4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
   a. Protect new and existing structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
   b. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
   c. All repairs to be made and paid for by Contractor.
5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.

3.2 SITE EXCAVATION AND GRADING

A. The site excavation and grading work includes the offsite disposition of all material:
   1. That exceed quantities required for earthwork on the project.
   2. That the Geotechnical engineer classifies as unclassified excavation.
   3. That the Geotechnical engineer classifies as unacceptable.
   4. That the Geotechnical engineer classifies as potentially contaminated.

B. Excavation and Grading:
   1. Perform as required by the Contract Drawings.
   2. Contract Drawings may indicate both existing grade and finished grade required for construction of Project.
      a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
      b. Perform other layout work required.
      c. Replace property corner markers to original location if disturbed or destroyed.
   3. Preparation of ground surface for embankments or fills:
      a. Before fill is started, scarify to a minimum depth of 6 inches in all proposed embankment and fill areas.
      b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
   4. Protection of finish grade:
      a. During construction, shape and drain embankment and excavations.
      b. Maintain ditches and drains to provide drainage at all times.
      c. Protect graded areas against action of elements prior to acceptance of work.
      d. Reestablish grade where settlement or erosion occurs.

C. Borrow:
   1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
   2. Include cost of all borrow material in original proposal.
   3. Fill material to be approved by Geotechnical Engineer prior to placement.

D. Construct embankments and fills as required by the Contract Drawings:
   1. Construct embankments and fills at locations and to lines of grade indicated.

a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.

2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 inches.
   a. Ensure that stones larger than 4 inches are not placed in upper 6 inches of fill or embankment.
   b. Do not place material in layers greater than 8 inches loose thickness.
   c. Place layers horizontally and compact each layer prior to placing additional fill.
3. Compact soils as required to obtain specified density. Selection of appropriate equipment is the Contractor's responsibility.
   a. In general, compact cohesive soils by sheepsfoot, and granular soils by pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
   b. Control moisture for each layer necessary to meet requirements of compaction.

E. Grading Tolerances: As shown on Drawings.

3.3 USE OF EXPLOSIVES

A. Blasting with any type of explosive is prohibited.

3.4 COMPACTION DENSITY REQUIREMENTS

A. Obtain approval from Geotechnical Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.

B. Provide dewatering system necessary to successfully complete compaction and construction requirements.

C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Geotechnical Engineer.

D. Stabilize subgrade with well graded granular materials as directed by Geotechnical Engineer.

E. Assure by results of testing that compaction densities comply with the following requirements:

1. Sitework:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Under Paved Areas, Sidewalks and Piping:		
Cohesive soils	95% per ASTM D698	-2 to +3% of optimum
Cohesionless soils	75% relative density per ASTM D4253 and ASTM D4254	
Unpaved Areas:		
Cohesive soils	90% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	65% relative density per ASTM D4253 and ASTM D4254	

2. Structures:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Inside of structures under foundations, under equipment support pads, under slabs-on-grade and scarified existing subgrade under fill material	98% per ASTM D698	-2 to +3% of optimum
Outside structures next to walls, piers, columns and any other structure exterior member	92% per ASTM D698	-2 to +3% of optimum

3. Specific areas:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Outside structures under equipment support foundations	98% per ASTM D698	-2 to +3% of optimum
Under void	85% per ASTM D1557	-2 to +3% of optimum
Granular fill under base slabs with pressure relief valves	75% relative density per ASTM D4253 and ASTM D4254 or 98% of ASTM D698	
Granular fill under building floor slabs-on-grade	70% relative density per ASTM D4253 and ASTM D4254	

3.5 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

A. General:

1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
2. Obtain fill and backfill material necessary to produce grades required.
   a. Materials and source to be approved by Geotechnical Engineer.
   b. Excavated material approved by Geotechnical Engineer may also be used for fill and backfill.
3. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.

B. Excavation Requirements for Structures:

1. General:
   a. Do not commence excavation for foundations for structures until Geotechnical Engineer approves:
      1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.
      2) Density and moisture content of site area compacted fill material meets requirements of specifications.
      3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
      4) Surcharge or mass fill material has been removed from construction area or portions thereof.
   b. Engineer grants approval to begin excavations.
2. Dimensions:
   a. Excavate to elevations and dimensions indicated or specified.

b. Allow additional space as required for construction operations and inspection of foundations.

c. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.

d. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.

   a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by Geotechnical Engineer.

   b. Remove unsuitable subgrade soils located below foundations. The bottom of the overexcavation shall be located outside the exterior limits of foundations around the perimeter of structure the following horizontal distance, whichever is greater:

      1) Distance equal to depth of overexcavation below bottom of foundations.

      2) 5feet.

      3) As directed by Geotechnical Engineer.

   c. When excavation has reached required subgrade elevations, notify Geotechnical Engineer, who will make an inspection of conditions.

      1) If Geotechnical Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide Subgrade Stabilization as specified herein.

4. Install working surface over approved subgrade.

   a. Minimum thickness: 6 inches.

5. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.

   a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.

   b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed to a depth of 6 inches and then compact to density stated in this Specification Section before fill material can be placed thereon.

   c. Do not carry excavations lower than shown for foundations except as directed by Geotechnical Engineer or Engineer.

   d. If any part of excavations is carried below required depth without authorization, notify Engineer and correct unauthorized excavation as directed. Corrections may include:

      1) Under soil supported footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.

         a) Concrete fill may be used to bring elevations to proper position.

      2) In locations other than those above, including slabs on grade and pile supported foundations, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Geotechnical Engineer.

      3) No extra compensation will be made to Contractor for correcting unauthorized excavations.

6. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.

7. Notify Geotechnical Engineer and Engineer as soon as excavation is completed in order that subgrades may be inspected.

   a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and

under retaining wall footings has been inspected and approved by the Geotechnical Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.

b. Geotechnical Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.

c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.

d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.

8. Dewatering:
   a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
   b. Groundwater shall be maintained at least 3 feet below the bottom of any excavation.
   c. Review Geotechnical investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.
   d. Employ dewatering specialist for selecting and operating dewatering system.
   e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
   f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
      1) Install groundwater monitoring wells as necessary.
   g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
9. Subgrade stabilization:
   a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Geotechnical Engineer.
   b. Provide compaction density of replacement material as stated in this Specification Section.
   c. Loose, wet, or soft materials, when approved by Geotechnical Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
   d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
   e. Remove and replace frozen materials as directed by Geotechnical Engineer.
   f. Method of stabilization shall be performed as directed by Geotechnical Engineer.
   g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Geotechnical Engineer.
10. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
    a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 degrees F before structure is completed and heated to a temperature of at least 50 degrees F.
11. Protection of structures:

a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.

12. Shoring:
    a. Shore, slope, or brace excavations as required to prevent them from collapsing.
    b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
    c. Construct shoring that is required to retain water as part of the dewatering system, using non-permeable details such as interlock sealant for sheet piles.
13. Drainage:
    a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
    b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
    c. Provide pumping required to keep excavated spaces clear of water during construction.
    d. Should any water be encountered in the excavation, notify Engineer and Geotechnical Engineer.
    e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
14. Frost protection:
    a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
    b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.
    c. Protect excavation from frost if placing of concrete or fill is delayed.
    d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
    e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 degrees F.

C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:

1. General:
    a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Geotechnical Engineer and scarified to a depth of 6 inches and compacted to density specified herein.
    b. Surface may be stepped by at not more than 12 inches per step or may be sloped at not more than 2%.
    c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Geotechnical Engineer as being free of undesirable material and compacted to specified density.
2. Obtain approval of fill and backfill material and source from Geotechnical Engineer prior to placing the material.
3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 12 IN of granular fill unless otherwise indicated.
4. Vapor barrier: Install a continuous vapor barrier under floor slabs-on-grade as required by Specification Section 07 26 00 and shown on Contract Drawings.

5. Fill and backfill placement:
    a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Geotechnical Engineer.
    b. Place fill and backfill material in 6 inches lifts.
    c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
    d. Use hand operated equipment for filling and backfilling within 5 feet of walls and less than 3 feet above pipes.
        1) Compaction equipment exceeding 3000 pounds dead weight shall not be used within 5 feet of the wall as a minimum
        2) Contractor is responsible for method of compaction so as not to damage wall.
    e. Use hand operated equipment for filling and backfilling next to walls.
    f. Do not place fill and backfill when the temperature is less than 40 degrees F and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
    g. Use vibratory equipment to compact granular material; do not use water.
6. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content as required to fill the specified overexcavation to bottom of foundation.

D. Filling and Backfilling Outside of Structures:

1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
2. Provide material as approved by Geotechnical Engineer for filling and backfilling outside of structures.
3. Fill and backfill placement:
    a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from Geotechnical Engineer.
    b. Place fill and backfill material to maximum allowable lift thickness indicated in Paragraph 3.5, C, 5, b of this Section.
    c. Compact material with equipment of proper type and size to obtain density specified.
    d. Use hand operated equipment for filling and backfilling within 5 feet of walls and less than 3 feet above pipes.
        1) Compaction equipment exceeding 3000 pounds dead weight shall not be used within 5 feet of the wall as a minimum
        2) Contractor is responsible for method of compaction so as not to damage wall.
    e. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
    f. Do not place fill or backfill material when temperature is less than 40 degrees F and when subgrade to receive material is frozen, wet, loose, or soft.
    g. Use vibratory equipment for compacting granular material; do not use water.
4. Backfilling against walls:
    a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
    b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
    c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
        1) See Contract Drawings for specific exceptions.

d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.

E. Backfilling Outside of Structures Under Piping or Paving:

1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.6 FIELD QUALITY CONTROL

A. All excavation, trenching, and related sheeting, bracing, etc. shall comply with the requirements of OSHA Standards, and state requirements. Where conflict between OSHA and state regulations exists, the more stringent requirements shall apply.

B. Special Inspection and Testing:

1. See Section 01 45 33.

C. Responsibilities of Special Inspector:

1. Review proposed materials for fill and backfill around structures.
2. All testing, observation and work indicated as being performed by the Geotechnical Engineer in this Specification Section.
3. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.
4. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
5. Extent of compaction testing will be as necessary to assure compliance with specifications.
6. Prepare and submit inspection and test reports to Engineer.
   a. Coordinate such work with other Special Inspectors.
7. Test reports to include the following:
   a. Report and certification of aggregate fill and drainage fill.
   b. Test reports on borrow material.
   c. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
   d. Field reports; in-place soil density and moisture tests.
   e. One optimum moisture-maximum density curve for each type of soil encountered.
   f. Report of actual unconfined compressive strength and/or results of bearing tests of each strata tested.
   g. Other documentation necessary for Geotechnical Engineer to approve earthwork.
   h. Assist Engineer to determine corrective measures necessary for defective work.

D. Responsibilities of Testing Agency for Site Excavation and Grading:

1. All testing, observation and work indicated as being performed by the Geotechnical Engineer in other than Article 3.5 of this Specification Section.
2. Services will include verification and documentation of satisfactory soil materials, subgrade quality, sampling, placement, moisture conditioning, compaction and testing of proposed soil materials, and field testing for quality control.

3. Moisture density relations, to be established by the Geotechnical Engineer required for all materials to be compacted.
4. Extent of compaction testing will be as necessary to assure compliance with specifications.

END OF SECTION

SECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Requirements for excavating, filling, and other earth Work for linear, buried utility projects, including:
    a. Field conditions.
    b. Soil and aggregate materials.
    c. Test pits.
    d. Excavation.
    e. Preparation of subgrades.
    f. Filling and compacting.
    g. Rough grading.
    h. Disposal of excavated spoil materials.

B. Related Requirements Include, but are not necessarily limited to, the following:

1. Section 31 10 00 - Site Clearing.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement:

1. Contractor shall provide all labor, materials, construction equipment and machinery, tools, and incidentals required or necessary for performing all trenching, backfilling, and related earth Work for the Contract, including all Work related to excavating, preparing subgrades, providing and stockpiling materials, filling with required materials, compacting, grading, proper disposal of excess spoil materials, and all other Work required by this Section. This Section includes trenching, backfilling, and related earth Work required for constructing: buried utilities, including piping and, where applicable, other Underground Facilities; site improvements (including pavement, sidewalks, curbs, and the like); subgrade preparation for other Work; and all other trenching, backfilling, and related earth Work required by the Contract Documents and not addressed under other Specifications sections.
2. Unless expressly indicated otherwise in the Contract Documents, such as Section 01 22 00 - Measurement and Payment, the Work of this Section is included in the various lump sum and unit price bid/pay items for the Contract.
3. All Work under this Section is unclassified and covered by this Section and the associated bid/payment item(s). No separate payment will be made for removing, handling, or disposing of rock (unless the Contract includes a separate bid/pay item specifically for rock excavation or rock removal), stones, concrete (whether or not reinforced), debris, stumps, and other material, regardless of moisture content, unless such material constitutes an unforeseen Hazardous Environmental Condition and Work associated with such Hazardous Environmental Condition is not included in the Contract.
4. Where excavation of test pits is required by the Contract Documents or Engineer, payment for such test pits will be in accordance with Paragraph 3.2.B of this Section and other applicable provisions of the Contract Documents.

1.3 REFERENCES

A. Terminology:

1. The following terms are not defined and are not indicated with initial capital letters but, when used in this Section, have the following meaning:

a. “Borrow” means material required for trenching, backfilling, and related earth Work in excess of quantity of suitable material available from required grading, cuts, and excavations at the Site. Borrow may be necessary even though not otherwise expressly required by the Contract Documents.

b. “Cohesive soil” means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical or near-vertical sideslopes, and is plastic when moist. Cohesive soil is difficult to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

c. “Cohesionless soil” means fill material that does not clump together; its grains remain separate and apart from each other. Cohesionless soils typically have a low proportion of fine (no. 200 mesh size and less) particles and may be soil material or granular material. The terms “cohesionless soils”, “cohesionless materials”, “non-cohesive soils”, and the like have the same meaning.

d. “Fill” means soil material, granular material, or other material indicated in this Section required for backfilling excavations or as material for achieving required rough grading. Unless indicated otherwise in the context of a specific provision, the terms “fill” and “backfill” have the same meaning, as do derivative terms such as, “filling” and “backfilling”. When used by itself, the term “backfill” means material required for refilling an excavation.

e. “Foundations” means bottoms of manholes, chambers, vaults, and similar structures; base slabs (slabs-on-grade); bearing directly on soil, granular material, or rock.

f. “Granular material” means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry. The terms “granular material”, “aggregate material”, and “granular soil” have the same meaning. Detailed requirements for specific types of granular material are indicated in Article 2.1 of this Section.

g. “Rock” means: igneous, metamorphic, or sedimentary rock or stone; boulders over two cubic yards in volume in open areas and boulders over one cubic yard in volume in trenches; and mass concrete; that cannot be removed using rippers and therefore requires drilling and blasting or use of large excavator-mounted pneumatic breakers. If rock is encountered during the Work, promptly furnish notice of differing subsurface condition in accordance with the General Conditions (as may be modified by the Supplementary Conditions); when necessary, Engineer will furnish requirements for rock removal via appropriate Contract modification. The following do not qualify as rock:

   1) Soft, weathered or disintegrated rock that can be removed by normal excavating equipment, including bulldozers with rippers and large trackhoes with rock teeth or rock buckets.

   2) Loose or previously blasted rock.

   3) Broken stone in rock fills.

   4) Rock or stone that falls into the excavation from outside limits of excavation shown or indicated in the Contract Documents.

   5) Boulders that can be removed without drilling, blasting, or pneumatic breakers.

   6) Pavements, sidewalks, and gutters of concrete, asphalt, or masonry.

h. “Subgrade” means the uppermost surface of native soil material unmoved from cuts; the bottom of excavation.

i. “Trenching” means excavating for buried utilities, other Underground Facilities, and related excavation Work. In this Section, the words, “trenching” and “excavating” have the same meaning. In this Section, the word “excavation”, whether singular or plural, is general and includes trenching.

j. “Unauthorized excavation” means removing materials beyond limits shown or indicated in the Contract Documents or otherwise directed by Engineer.

k. “Unclassified”, when used in referring to trenching, excavating, or excavations, means excavation and disposal of all materials, of any description whatsoever, encountered in performing the Work, unless otherwise shown or indicated in the Contract Documents.

l. “Unsuitable soil materials” means soil or other materials encountered at or below subgrade elevation of insufficient strength, stiffness, or characteristics to support the Work in accordance with the Contract Documents or as determined by Engineer. The terms “unsuitable soil material”, “unsuitable soil”, and “unsuitable material” have the same meaning.

B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. AMRL R18 - AASHTO Accreditation Procedure Manual.
2. ASTM International (ASTM):
   a. C33/C33M - Standard Specification for Concrete Aggregates.
   b. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   c. D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
   d. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   e. D2166 - Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.
   f. D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
   g. D2434 - Standard Test Methods for Measurement of Hydraulic Conductivity of Coarse-Grained Soils.
   h. D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   i. D2850 - Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils.
   j. D3740 - Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   k. D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   l. D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   m. D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   n. D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
   o. D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   p. D7928 - Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
   q. E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.4 QUALITY ASSURANCE

A. Qualifications:

1. Contractor’s Testing Laboratory:
   a. Retain the services of independent testing laboratory to perform testing and determine compliance with the Contract Documents of materials specified in this Section.

b. When Contractor is expressly required, by this Section's "Field Quality Control" Article or elsewhere in the Contract Documents, to retain testing laboratory for tests required under this Section's "Field Quality Control" Article, retain one testing laboratory for quality assurance testing and field quality control testing.

c. Testing laboratory shall possess current, valid accreditation from the AASHTO Materials Reference Laboratory (AMRL), in accordance with AASHTO AMRL R18, for ASTM D3740, for tests required for quality assurance testing indicated in this Article and field quality control testing indicated to be Contractor's responsibility.

d. Testing laboratory shall comply with ASTM E329.

e. Testing laboratory shall be experienced in the types of testing required.

f. Selection of testing laboratory is subject to Engineer's acceptance. Upon Engineer's request, submit qualifications statement for testing laboratory, including name of entity, location, copies of applicable certifications, summary of entity's experience, and names and qualifications of personnel who will perform the subject sampling and testing.

B. Quality Assurance Testing:

1. Quality assurance testing, which may also be regarded as source quality control testing, is in addition to field quality control testing required by this Section's "Field Quality Control" Article.
2. Materials used in the Work may require testing and retesting, as directed by Engineer, during the Project. Allow free access to onsite material stockpiles, borrow sources, and other sources of aggregate and soil materials at all times. Tests not specifically indicated to be performed at Owner's expense (if any), including retesting of defective materials and defective Work, shall be at Contractor's cost.
3. Contractor's Testing Laboratory Scope for Quality Assurance Sampling and Testing:
   a. Obtain samples and perform testing of proposed fill materials in the laboratory, at the Site, and at borrow locations (if any) to provide assurance that the Work will comply with the Contract Documents.
   b. Testing laboratory shall perform testing required to obtain data for selecting moisture content for placing and compacting fill materials.
   c. Submit to Engineer, via Contractor, written results of each test.
4. Required Quality Assurance Material Testing by Contractor's Testing Laboratory:
   a. Perform the following quality assurance tests on materials to be incorporated into the Work. Submit results of such tests to Engineer and obtain Engineer's acceptance thereof prior to incorporating the subject materials into the Work.
   b. Gradation in accordance with ASTM D6913 and ASTM D7928. Perform one test for every 1,000 cubic yards of each material to be incorporated into the Work.
   c. Atterberg limits in accordance with ASTM D4318. Perform one test for every 1,000 cubic yards of the following types of materials to be incorporated into the Work: suitable soil material, and soil structural fill.
   d. Moisture/density relations for fill in accordance with ASTM D698, ASTM D1557, ASTM D4253, or ASTM D4254, as applicable. Perform one test for every 1,000 cubic yards of each material to be incorporated into the Work.
   e. Moisture content of stockpiled or borrow material in accordance with ASTM D2216. Perform one test for every 1,000 cubic yards of each material to be incorporated into the Work.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:

1. Shop Drawings:
   a. Schedule (table or written narrative) indicating, for each specific area of the Work, type of fill materials proposed, together with indication of whether source of materials is

onsite or borrow source. Identification of each type of material shall employ material names/designations identical to those in the Contract Documents.

2. Product Data:
    a. Borrow Soil Materials: Name and address of Supplier of borrow soil materials, gradation, and Supplier's certification that materials are sufficiently free of Constituents of Concern so that a Hazardous Environmental Condition will not be created or exacerbated. If no soil materials will be obtained from any borrow location, expressly so indicate to Engineer in writing.
    b. Aggregate: Supplier's published description of aggregate materials, including name and address of Supplier, certification of material's compliance with AASHTO and state department of transportation standards, and gradation.

B. Informational Submittals: Submit the following:

1. Procedure Submittals:
    a. Excavation plan indicating:
        1) Excavation Method(s): Indicate high-level methods to be used for excavating, such as use of backhoe or other earth moving construction equipment, use of explosives in excavating (when allowed), trenchless excavating methods, micro-trenching, hydro-excavating (when allowed), air vacuum excavating (when allowed), or other. Where different methods will be used, indicate locations of each in the Work. Purpose of indicating high-level excavating methods is for Owner's information regarding effect of excavating method on Owner's or facility manager's (if other than Owner) property and operations.
        2) Copies of permits and approvals required for trenching, backfilling, and related earth Work, obtained from authorities having jurisdiction, including owners of affected utilities and transportation facilities, for excavation methods proposed.
    b. Compaction procedure and compaction equipment proposed for use. Where different procedures or equipment will be used for compacting different types of material or at different locations at the Site, indicate where each procedure and equipment item will be used.
    c. Engineer's acceptance of excavation plan does not, in any way, modify Contractor's sole responsibility for complying with the Contract Documents, construction means, methods, procedures, techniques, or sequences, and safety and protection measures incident thereto.
2. Quality Assurance Test Results Submittals:
    a. Submit results of quality assurance testing performed in accordance with this Section's "Quality Assurance" Article, unless included as part of another submittal under this Section. Submit results for the following quality assurance testing:
        1) Tests on materials from onsite and borrow sources.
        2) Optimum moisture – maximum dry density curve for each type of fill material.
3. Field Quality Control Submittals:
    a. Submit results of testing and inspection performed in accordance with the field quality control Article in Part 3 of this Section, including:
        1) Indication of soil classification in accordance with ASTM D2487.
        2) Field density testing.
        3) Proctor Compaction Test to determine optimum moisture for soil and maximum dry density.
4. Qualifications Statements:
    a. Quality assurance testing laboratory, when requested by Engineer.

1.6 FIELD CONDITIONS

A. Existing Conditions:

1. Subsurface Conditions:
    a. Subsurface Information: The Supplementary Conditions indicate information (if any) that is Technical Data on subsurface conditions at the Site. Such information and data are not intended as a representation or warranty of continuity of conditions between soil borings or test pits, nor of groundwater levels at dates and times other than date and time when measured, nor that purpose of obtaining the information and data were appropriate for use by Contractor. Owner and Engineer are not responsible for interpretations or conclusions drawn therefrom by Contractor.
    b. Contractor's Explorations: Soil borings and other exploratory operations may be made by Contractor, at no additional cost to Owner. Coordinate Contractor-performed test borings and other exploratory operations with Owner, utility owners, and owners of transportation facilities as appropriate. Perform such explorations without disrupting or otherwise adversely affecting operations of Owner and others.
2. Where subsurface conditions or locations of Underground Facilities and structures are unforeseen or differ substantively from that shown or indicated in the Contract Documents, comply with Contract requirements for giving notice and other actions.
3. Existing Structures and Underground Facilities:
    a. The Contract Documents show or indicate certain structures and Underground Facilities adjacent to the Work. Such information was obtained from existing records and is not guaranteed to be correct or complete. Contractor shall explore ahead of the excavation to determine the exact location of all existing structures and Underground Facilities. Existing structures and Underground Facilities shall be supported and protected from damage by Contractor. Immediately repair and restore existing structures and Underground Facilities damaged by Contractor without additional cost to Owner.
    b. Movement or operation of construction equipment and machinery over Underground Facilities shall be at Contractor's sole risk. When required by owner of the Underground Facility, prepare and submit to owner of such Underground Facility, and obtain their acceptance, of Contractor's plan presenting Contractor's analysis of the loads to be imparted during construction (including transient loading by construction equipment, machinery, and vehicles) and Contractor's proposed measures to protect structures and Underground Facilities during the Work.
    c. Acceptance of or approval by utility owner or Engineer of Contractor's proposed evaluation and method(s) for protecting Underground Facilities in no way modifies or reduces Contractor's sole responsibility for complying with the Contract Documents, means, methods, procedures, techniques, and sequences of construction, and the safety and protection measures incident thereto.
    d. Coordinate with utility owners for shut off of services in active piping and conduits. When required by utility owner, Owner will assist Contractor with utility owner notifications. Completely remove buried piping and conduits indicated for removal and not otherwise indicated as being abandoned or to remain in place.
    e. In general, service lines and laterals to individual residences, businesses, buildings, and structures, are not shown; however, Contractor shall assume that a service exists for each utility owner to each residence, business, building, structure, and property.
    f. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when such interruption is indicated in the Contract Documents or when allowed in writing by Engineer after acceptable temporary utility services are provided by Contractor for the affected structure or property.

PART 2 - PRODUCTS

2.1 MATERIALS

1. Provide granular under-slab fill under foundations, manholes, chambers, vaults, handholes, and similar Work unless other under-slab material is required by the Contract Documents.
2. ASTM C33/C33M gradation size no. 67, or other material acceptable to Engineer.

3. Material shall be uniformly-graded, washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, free of organic and deleterious material, complying with the following:
    a. 100 percent passing a 1.5-inch sieve.
    b. Not more than five percent passing a no. 4 sieve.

B. Granular Structural Fill:

1. Granular structural fill, sometimes called “select granular fill”, is required for improving subgrade (after removal of unsuitable material), as backfill for excavations in areas that, after restoration, will be subject to vehicular traffic, and at other locations shown or indicated for such material in the Contract Documents.
2. Material shall be well-graded, crushed aggregate, free of organic and deleterious material.

C. Soil Structural Fill:

1. At Contractor’s option, soil structural fill may be low-volume change cohesive soil material or granular soil material.
2. Free of organic and deleterious matter, frozen material and debris.
3. Low-volume change cohesive soil material:
    a. ASTM D2487 classification: CL-ML or CL.
    b. Liquid limit: Less than 45.
    c. Maximum plasticity index: 20.
4. Granular soil material:
    a. ASTM D2487 classification: GW, GP, GM, GC, SW, SP, SM or SC.
5. Previously excavated materials complying with the Contract Documents requirements for soil structural fill may be used for soil structural fill.
6. When onsite materials are unsuitable for use as soil structural fill, provide granular structural fill or approved borrow material as soil structural fill. Prior to using borrow material as soil structural fill, furnish product data Submittal and quality assurance Submittal for proposed material and obtain Engineer’s approval and acceptance (as applicable) of the proposed material.

D. Suitable Soil Material as Non-Structural Fill:

1. Provide suitable soil material as fill for the Work, unless other material is required.
2. Material shall be:
    a. Free of rock larger than three inches in any dimension, debris, waste, frozen materials, organic material, and other deleterious material.
    b. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML or CL.
    c. Liquid limit: Not greater than 45.
    d. Plasticity index: not greater than 20.
3. Previously-excavated materials complying with the Contract Documents requirements for suitable soil material may be used for suitable soil material.
4. When onsite materials are unsuitable for use as suitable soil material, provide soil structural fill or approved borrow material as suitable soil material. Prior to using borrow material as suitable soil material, furnish product data Submittal and quality assurance Submittal for proposed material and obtain Engineer’s approval and acceptance (as applicable) of the proposed material.

E. Subbase Material:

1. Subbase material is granular material underlying pavement, sidewalks, and other surfaces expressly indicated in the Contract Documents.
2. Material shall be naturally- or artificially-graded mixture of natural or crushed gravel, crushed stone, or natural or crushed sand. Slag is unacceptable.

F. Pipe Bedding Material:

1. Materials: Unless otherwise expressly required in the Contract Documents, pipe bedding material shall be crushed stone and gravel, free of: rock or gravel larger than one-inch in any dimension, debris, waste, frozen materials, organic material and other deleterious matter.
2. Sand:
    a. Where expressly required or allowed by the Contract Documents, provide sand as pipe bedding material.
    b. Sand material, where used, shall consist of natural or manufactured granular material and shall contain no organic material.
    c. Sand shall be non-plastic, when tested in accordance with ASTM D4318.
    d. Gradation: 100 percent shall pass a no. 4 sieve and not more than five percent shall pass a No. 200 sieve.

G. Flowable Fill, also known as Controlled Low Strength Material (CLSM):

1. Unless expressly required otherwise by the Contract Documents, flowable fill may be used, at Contractor's option (following Engineer's approval), for backfilling in lieu of the following materials: granular structural fill, pipe bedding material, soil structural fill, suitable soil material used as non-structural fill, and subbase material.
2. Comply with Section 03 31 - Concrete Materials and Proportioning.
3. Material provided shall be excavatable by ordinary mechanical excavation equipment, such as backhoes.

2.2 SOURCE QUALITY CONTROL

A. Tests and Inspections at Source of Supply:

1. Perform quality assurance testing, and submit results to Engineer, in accordance with the "Quality Assurance" Article in Part 1 of this Section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:

1. Provide Engineer with sufficient notice and with means to examine areas and conditions under which trenching, backfilling, other related earth Work, and grading will be performed. Engineer will advise Contractor in writing when Engineer is aware of conditions that may be detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.
2. This Article, however, in no way modifies or reduces Contractor's sole responsibility for complying with the Contract Documents, for construction means, methods, procedures, techniques, and sequences, and for the safety and protection measures incident thereto.
3. Nothing in this Article, including action by Engineer or Resident Project Representative (if any), is for benefit of Contractor.

B. Installing the Work constitutes Contractor's approval of underlying work, subgrades, and field conditions prevailing at the time of the Work.

3.2 PREPARATION

A. Site Preparation:

1. Comply with Section 31 10 00 - Site Clearing.
2. Comply with this Section's "Erosion and Sediment Control During Construction" Article.

3.3 EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION

A. Temporary Erosion and Sediment Controls – General:

1. Provide temporary erosion and sediment controls to maintain compliance with the site's SWP3.
2. When applicable, also comply with requirements of the erosion and sediment control plan approved by authorities having jurisdiction and the Project's storm water pollution prevention plan and permit, if any.

3.4 EXCAVATION

A. Excavation – General:

1. Perform all excavation Work, including trenching and backfilling, required to complete the Work as shown, specified, and required. Excavating Work includes removing, handling, and proper disposal of earth, sand, clay, expansive-type soils, other unsuitable soil materials, gravel, hardpan, soft, weathered or decomposed rock, concrete and masonry (reinforced or unreinforced), pavements, rubbish, debris, stumps, and other materials, regardless of moisture content, within the excavation limits.
2. Trenching and backfilling Work shall comply with the Contract Documents, including required grades, elevations, general dimensions, and alignment shown or indicated on the Drawings including cuts and fills, as applicable.
3. Protect existing buildings and structures against undermining and destabilization. If adjacent trenching affects foundations of one or more buildings or structures, promptly advise Engineer in writing.
4. If unsuitable material and obstructions are encountered during excavation, remove material and replace as directed by Engineer.

B. Excavation Methods:

1. Traditional Excavation Methods: Excavation via traditional methods, such as backhoe, bulldozer, other earth moving construction equipment or machinery, or excavation using hand tools, is acceptable for all excavating Work.
2. Use of Explosives:
   a. Use of explosives is not allowed.
3. Micro-trenching: Installation of buried utilities using micro-trenching equipment and techniques is acceptable when the associated Underground Facility is of a size and depth appropriate for such construction method. Submit to Engineer request for interpretation or clarification for requirements for resin backfilling of micro-trenches. Engineer will issue such requirements via Field Order.
4. Trenchless: Where Contractor proposes trenchless construction techniques, such as directional drilling, micro-tunneling, or others, comply with the Contract Documents regarding such construction methods. When the Contract Documents do not include requirements for the proposed trenchless construction method, submit to Engineer request for interpretation or clarification to obtain appropriate requirements, which will be issued via appropriate Contract modification.

C. Excavation Protection:

1. Provide excavation protection system(s) in accordance with Laws and Regulations to prevent injury to persons and property, including Underground Facilities.
2. Provide safe access to excavations, including emergency exit, and safe access for construction equipment and machinery, where applicable, in accordance with laws and Regulations.

D. Subgrades – General:

1. Provide firm, dense, thoroughly compacted, consolidated subgrades, free of mud, muck, and other soft and unsuitable materials. Subgrades shall remain firm and intact under all construction operations. Reinforce subgrade by providing granular structural fil] on subgrades that are otherwise solid but become soft or muddy on top due to construction operations. Finished elevation of stabilized subgrades shall not be above subgrade elevations shown on the Drawings.

2. If, in Engineer's opinion, subgrade becomes soft, muddy, or both, because of construction delays, failure to dewater properly, or other cause within Contractor's control, excavate subgrade to firm material, trim the subgrade, and backfill with granular structural fill material at Contractor's cost.
3. Preparation of Subgrades for Subsequent Work:
    a. Level off subgrades to receive foundations or compacted fill.
    b. Where subgrades are to receive subsequent fill or manholes, chambers, vaults, or similar items, remove loose materials and bring subgrades into compliance with the Contract Documents.
    c. Where compacted fill material is required to bring subgrade up to underside of construction, scarify existing subgrade upon which fill material will be placed to depth of six inches and then compact to density required in this Section before fill material is placed thereon.
    d. Do not excavate lower than required for buried piping or foundations, unless directed otherwise by Engineer.
    e. Where excavation extends below required elevation without authorization, promptly advise Engineer and remedy unauthorized excavation in accordance with the Contract Documents. Corrections may include:
        1) Under soil-supported foundations or soil-supported retaining walls:
            a) Filling entire vertical distance between excavated subgrade and material required under foundation or other structure with compacted granular structural fill.
            b) Concrete fill is acceptable for bringing elevations to proper position.
        2) For locations other than those indicated above including slabs-on-grade:
            a) Backfill and compact unauthorized excavations as indicated for authorized excavations of same classification, unless otherwise directed by Engineer.
        3) Contractor is not eligible for change in Contract Price or Contract Times for remedying unauthorized excavations.
4. Evaluation and Protection of Subgrade:
    a. Advise Engineer as soon as excavation is completed for Engineer's observation of subgrades and, where necessary or required, inspection and testing of subgrades.
    b. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide subgrade stabilization as indicated in this Article.
    c. Do not commence further construction until subgrade under compacted fill material, under foundations and retaining walls is acceptable (in accordance with the Contract Documents) to Engineer, who may consider results of required testing, and who may elect to consult with geotechnical consultant (if any).
    d. Engineer shall have sufficient opportunity to observe subgrade, after successful completion of tests and inspections required by the Contract Documents.
    e. Place fill material and perform subsequent construction after subgrade is acceptable in accordance with the Contract Documents.
    f. Protect subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
5. Subgrade stabilization:
    a. If subgrade under foundations or fill material, is frozen, loose, wet, or soft before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Engineer, who may consult with geotechnical consultant.
    b. Loose, wet, or soft materials, when approved by Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
    c. Stabilization shall be in accordance with the Contract Documents. Where the Contract Documents do not address subgrade stabilization, promptly submit to Engineer written

request for clarification or interpretation, or other written instrument in accordance with the Contract Documents. In such event, do not proceed until response is obtained from engineer.

E. Preparation for Slabs-on-Grade:

1. Do not place slabs-on-grade until all the following conditions are met:
   a. Subgrade is acceptable in accordance with the Contract Documents.
   b. Required fill material (where applicable) has been provided on subgrade in accordance with the Contract Documents.
   c. Underground Facilities are installed and have successfully completed required field testing and inspections.

F. Freeze Protection:

1. Do not place foundations or fill material on frozen subgrade.
2. When freezing temperatures are expected, based on widely recognized, reputable source for weather forecasts at or near the Site, do not excavate to full depth indicated, unless foundations or fill material can be placed immediately after excavation has been completed and is acceptable in accordance with the Contract Documents.
3. Protect from freezing excavation, subgrade, and fill materials when subsequent Work thereon is delayed.

G. Construction Traffic on Soils:

1. Furnish and use appropriate backhoe or other low-contact pressure equipment to remove existing materials.
2. Minimize construction traffic on existing materials and saturated soils and avoid soil disturbance.
3. Repair disturbed subgrade materials prior to performing subsequent Work. Remedial work shall be in accordance with the Contract Documents. When not addressed in the Contract Documents, remedial Work shall be as directed by Engineer via appropriate Contract modification.
4. Allow only minimal foot traffic on bearing soils prepared for subsequent installation of fill or foundations.

3.5 FILLING AND COMPACTING

A. Filling and Compacting – General:

1. Provide and compact all fill required for the finished grades as shown and as indicated in this Section.

B. Place fill as promptly as progress of the Work allows, but not until completing the following:

1. Obtaining Engineer's concurrence, after observation by Engineer or Resident Project Representative (if any) of construction below finish grade, including removal of trash and debris from excavations, waterproofing (where required), and related Work.
2. Successful completion of required field quality control activities for Work that will be covered or concealed by filling, including field quality control testing of buried piping, conduits that will convey fluid or gas, and exfiltration testing (where performed or required) of manholes, chambers, vaults, and similar items. For manholes, chambers, and vaults, where infiltration testing or vacuum testing is performed or required, such testing may be performed following backfilling.
3. Completion of proper documentation of as-constructed conditions and existing conditions (such as locations of Underground Facilities).
4. Removal of temporary supports of excavations.
5. Remove fill that includes organic materials or other unacceptable material and replace with fill material complying with the Contract Documents.

C. Placement – General:

1. Place fill to the grades shown or indicated. Bring up evenly on all sides fill around manholes, chambers, vaults, and similar items, and Underground Facilities.
2. Management of Moisture Content:
    a. Place fill materials at moisture content and density as indicated in this Article's requirements on compaction density. Prior to placing fill material, optimum moisture and maximum density properties for proposed material shall be obtained from Engineer, who may consult with geotechnical consultant, if any. Furnish and use construction equipment and machinery capable of adding measured amounts of water to fill materials to bring fill materials to a condition within required moisture content range. Control moisture for each lift necessary for required compaction.
    b. Furnish and use construction equipment and machinery capable of discing, aerating, and mixing fill materials to ensure reasonable uniformity of moisture content throughout fill materials, and to reduce moisture content of borrow materials by air drying, when necessary.
    c. When subgrade or fill materials requires moisture-conditioning before compaction, fill material shall be sufficiently mixed or worked on the subgrade to ensure uniform moisture content throughout the lift of material to be compacted.
    d. Materials at moisture content in excess of specified limit shall be dried by appropriate means, such as aeration or stockpiling for gravity drainage and air drying.
3. Compaction:
    a. Compaction Equipment:
        1) Perform compaction with construction equipment and machinery suitable for the type of fill material placed. Unless otherwise required, compact cohesive soils using sheepsfoot compactor, and compact granular materials using pneumatic rollers, vibrators, or other construction equipment or machinery to obtain required density.
        2) Select and use equipment capable of providing the minimum density required in the Contract Documents.
        3) Use light compaction equipment and machinery, with equipment or machinery gross weight not exceeding 7,000 pounds within horizontal distance of 10 feet from the wall of completed, below-grade manholes, chambers, vaults, and similar items, and walls of adjacent buildings or structures.
        4) Furnish and use construction equipment and machinery capable of compacting in restricted areas next to structures and around piping and Underground Facilities.
    b. Compaction Test Area:
        1) Effectiveness of construction equipment and machinery selected by Contractor for compacting, shall be tested at start of compacted fill Work by constructing a small section of fill within the area where fill will be placed.
        2) If tests on the test section of fill indicate that required compaction is not obtained, do one or more of the following: increase the quantity of coverages, decrease the lift thicknesses, or use different compactor equipment or machinery.
4. Placement of Lifts and Compaction:
    a. Place fill materials in horizontal, loose lifts, not exceeding specified thickness prior to compacting.
    b. Place fill in manner ensuring uniform lift thickness after placing.
    c. Preparation of surfaces for placement of fill:
        1) Before commencing placing of fill, scarify underlying material to depth of six inches.
        2) Where ground surface is steeper than one vertical to four horizontal ("1V:4H"), plow surface to bench and break up surface so that fill material will bind with existing surface. For slopes steeper than 1V:4H and less than 1V:1.5H, bench shall be six feet wide. For slopes steeper than or equal to 1V:1.5H and less than 1V:0.5H, bench shall be four feet wide.

d. Mechanically compact each lift, by not less than two complete coverages of compactor. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of compactor's compacting surface.

e. Compaction of fill materials by inundation with water is unacceptable.

5. Restrictions:

a. Do not place fill materials when standing water is present on surface of area where fill will be placed.

b. Do not compact fill when standing water is present on the fill to be compacted.

c. Do not place or compact fill in frozen condition or on top of frozen material.

d. Fill containing organic or deleterious materials or other unacceptable material previously described shall be removed and replaced prior to compaction.

6. If required densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment or machinery, perform all work necessary to provide required densities. Such work shall include, at no additional cost to Owner, complete removal of unacceptable fill areas and replacement and re-compaction until acceptable fill is provided.

7. Repair, at Contractor's cost, observed or measured settlement. Make repairs and replacements as necessary and required within 30 days after being so advised by Engineer, unless more-timely action is necessary to avoid or reduce the potential for safety hazards or damage to property.

D. Temporary Pavement:

1. Provide not less than 1.5 inches of temporary bituminous pavement immediately after filling excavations in paved roads and other pavement subject to vehicular traffic, where such pavement will remain permanently.

2. Maintain surface of paved area over the fill in good and safe condition during progress of the Work, and promptly fill depressions over and adjacent to the fill area caused by settlement of fill.

3. Permanent replacement pavement shall be equal to that of the existing roadways, unless otherwise shown or specified.

E. Compaction Density Requirements:

1. Compaction Requirements for Sitework (including civil, grading, and Underground Facilities):

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Under Pavement, Other Traveled Ways, Curbs, Gutters, Sidewalks, and Buried Utilities (including manholes, chambers, vaults, and similar items):		
Cohesive soils	95% per ASTM D698	-2 to +3% of optimum
Cohesionless soils	75% relative density per ASTM D4253 and ASTM D4254	
Sitework Not Covered by the Above Category or Classification:		
Cohesive soils	90% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	65% relative density per ASTM D4253 and ASTM D4254	

2. Compaction Requirements for Materials Supporting Foundations and Adjacent to Buildings and Structures:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Fill supporting foundations and fill adjacent to exterior of buildings and structures, adjacent to walls, piers, and columns	95% per ASTM D698	-2 to +3% of optimum

3. Compaction Density and Moisture Requirements for Specific Areas:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Outside buildings and structures, under slabs-on-grade	98% per ASTM D698	-2 to +3% of optimum

4. Fill Lift Thickness:
   a. Unless expressly shown or indicated otherwise, place fill in trenches, below piping, below foundations, or under paved areas in horizontal uncompacted layers not exceeding six inches deep, and thoroughly compact each before next layer is placed.
   b. In pipe trenches, above elevation of bottom of pipe, horizontal uncompacted layers shall be six inches deep.
5. Fill Moisture Content: Fill shall be wetted and thoroughly mixed to achieve moisture content to within the required range indicated in the applicable table, above, with the following exception(s):
   a. On-site clayey soils: Optimum to plus three percent (moisture less than optimum is unacceptable).
6. Replace natural, undisturbed soils or compacted soil subsequently disturbed or removed by construction operations with materials compacted as indicated.
7. Field quality control testing for density; to verify that specified density was obtained, will be performed during each day of compaction Work. Responsibility for field quality control testing is indicated in this Section's "Field Quality Control" Article.
8. When field quality control testing indicates unsatisfactory compaction, provide additional compaction necessary to obtain the required compaction. Perform additional compaction Work at no additional cost to Owner until required compaction is achieved. Such work includes complete removal of unacceptable (as determined by Engineer) fill areas and replacement and re-compaction until acceptable fill is provided in accordance with the Contract Documents.

F. Replacement of Unacceptable Excavated Materials: In cases where over-excavation to replace unacceptable soil materials is required, backfill the excavation to required subgrade with granular structural fill material and thoroughly compact in accordance with applicable table in this provision. Slope the sides of excavation in accordance with the maximum allowable inclinations specified for each element of the Work.

3.6 UNAUTHORIZED EXCAVATION

A. Unauthorized Excavation – General:

1. Excavations outside lines and grades shown or indicated and that are not approved by Engineer (including excavations below required subgrade elevation, unless Engineer directs removal of unsuitable subgrade material), together with removing and disposing of the associated material, shall be at Contractor's cost and risk.
2. Fill unauthorized excavations with properly compacted granular structural fill material at Contractor's cost.

3.7 PAVEMENT SUBBASE COURSE

A. Pavement Subbase – General:

1. Place subbase material, in layers of specified thickness, over subgrade to support pavement base course.

2. Prepare subgrade underlying subbase course in accordance with this Section's general requirements for subgrades.

B. Grade Control:

1. During construction, maintain lines and grades including crown and cross-slope of subbase course.
2. Comply with Section 01 71 23 - Field Engineering, regarding staking and elevation controls.

C. Placing of Pavement Subbase Course:

1. Provide subbase material where required to the limits shown or indicated.
2. Place subbase course material on prepared subgrade in layers of uniform thickness, in accordance with indicated cross-section and thickness. If the Contract Documents do not show or indicate required section of replacement paving, replacement subbase course shall be of thickness equal to existing subbase course.
3. Maintain optimum moisture content for compacting subbase material during placing operations.
4. After completing compaction, other than that necessary for bringing material for the next course, do not haul or drive over compacted subbase.
5. To prevent softening of subgrade, do not install pavement subbase in excess of 100 feet in length without compacting.
6. If subgrade material becomes churned up into or mixed with subbase material, remove the mixed material and replace with clean, compacted subbase material.

3.8 GRADING

A. Grading – General:

1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
2. Backfilled trenches must be graded to drain, and surrounding areas must promote positive drainage. No ponding will be accepted in backfill areas or surrounding area.
3. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines:

1. Grade areas adjacent to building lines to drain away from buildings and structures.
2. Grade to prevent ponding of water. Provide grades and slopes as shown on the Drawings and to allow effective drainage to proper drainage routes, such as catch basins, ditches or swales intended to convey storm water, and other storm water drainage routes. Where intended grade for effective drainage is unclear, promptly submit to Engineer request for interpretation and obtain Engineer's interpretation or clarification before proceeding,
3. Provide final surfaces free of irregular surface changes, in accordance with the following:
    a. Grassed Areas and Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than one inch above or below required subgrade elevations.
    b. Sidewalks: Shape surface of areas under sidewalks to line, grade, and cross section, with finish surface not more than one inch above or below required subgrade elevation.
    c. Pavement (including hard-surfaced pavement and areas with stone surfacing): Shape surface of areas under pavement to line, grade, and cross section, with finish surface not more than 0.5-inch above or below required subgrade elevation.

C. Grading Surface of Fill Under Concrete Slabs-on-Grade:

1. Grade smooth and even, free of voids, compacted as specified, and to required elevation.
2. Provide final grades within tolerance of 0.5-inch when tested with a ten-foot straight edge.

3.9 DISPOSAL OF EXCAVATED SPOIL MATERIALS

A. Spoil Disposal - General:

1. Contractor shall haul away excavated material that does not comply with requirements for fill, or is in excess of quantity required for fill.
2. Disposal of materials shall comply with Laws and Regulations, at no additional cost to Owner.

3.10 FIELD QUALITY CONTROL

A. Site Tests and Inspections:

1. Testing Laboratory:
   a. Employ a testing laboratory to perform field quality control testing.
   b. Testing Laboratory Scope:
      1) Perform field moisture content tests (in accordance with ASTM D2216 or ASTM D6938) and density tests (in accordance with ASTM D1556 or ASTM D6938) to verify that required compaction of fill materials was provided.
      2) Tests of actual unconfined compressive strength or bearing tests (in accordance with ASTM D2850 or ASTM D2166) on each stratum.
      3) Furnish to Engineer and Contractor written results of each test.
   c. Authority and Duties of Testing Laboratory:
      1) Testing laboratory representatives ("technician") shall inspect the materials in the field, perform testing, and report findings to Engineer and Contractor. When the Work is defective, technician will direct attention of Engineer and Contractor to such defective Work.
      2) Technician shall not supervise performance of any of Contractor's Work. Technician shall not perform other duties for Contractor.
      3) Work will be tested and inspected by testing laboratory as the Work progresses, but failure to detect defective Work (including defective materials) shall not, in any way, prevent later rejection when defect is discovered, nor shall it obligate Engineer for Substantial Completion or final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release requirements of the Contract Documents, or to approve or accept any portion of the Work.
2. Responsibilities and Duties of Contractor:
   a. Use of testing laboratory or geotechnical consultant in no way relieves Contractor of responsibility to provide Work in compliance with the Contract Documents.
   b. When Owner furnishes services of testing laboratory, geotechnical consultant, or any combination thereof, for trenching, backfilling, and related earth Work, Owner and Engineer do not represent that the sampling and testing performed by Owner-hired testing laboratory or observations by Owner-hired geotechnical consultants, is sufficient for Contractor's purposes, or to monitor all aspects of the trenching, backfilling, and related earth Work. If additional quality control is needed to verify that the Work performed and materials delivered to the Site are in accordance with the Contract Documents, Contractor may retain its own, independent testing laboratory to perform additional sampling and testing for Contractor's purposes.
   c. To facilitate testing laboratory and geotechnical consultant, Contractor shall advise testing laboratory and geotechnical consultant not less than two days in advance of filling operations to allow for completion of field quality control testing and for assignment of personnel.
   d. Contractor shall be responsible for providing required compaction for fill and other earthwork. Contractor shall control construction operations by performing confirming tests to verify that Contractor has complied with the Contract Documents relative to compaction and moisture content.

e. Contractor shall demonstrate adequacy of compaction equipment and procedures before exceeding one or more of the following quantities of earthwork. Each test location shall include tests for each layer, type, or class of fill to finish grade.
    1) 200 linear feet of trench fill.
    2) 10 cubic yards of granular structural fill.
    3) 100 cubic yards of suitable soil material.
    4) 50 cubic yards of subbase material.

3. Testing laboratory will inspect and indicate acceptable subgrades and fill layers before construction work is performed thereon. Testing of subgrades and fill layers shall be as follows:
    a. Trenches for Underground Facilities (including buried ductbanks):
        1) In Open Fields: Two locations every 1,000 linear feet.
        2) Along Dirt or Gravel Roads or Off Traveled Right-of-Way: Two locations every 500 linear feet.
        3) Crossing Paved Roads: Two locations along each crossing.
        4) Under Pavement Cuts or Within Two Feet of Pavement Edges: One location every 400 linear feet.
    b. For granular structural fill: Once per lift for each 1,000 square feet placed and compacted.
    c. For soil structural fill:
        1) For backfilling trenches directly adjacent to buildings or structures, on 30-foot intervals on all sides of the building or structure for every compacted lift, but not less than one per lift on each side of the building or structure for buildings or structures less than 60 feet long on a side.
        2) For material not used as fill against buildings or structures, once per lift for each 1,000 square feet placed and compacted.
    d. For Suitable Soil Material: One per 1,000 square feet on every compacted lift.
    e. Subbase Material: One per 1,000 square feet on every compacted lift.
4. Periodic compliance tests will be made by Engineer to verify that compaction is in accordance with the Contract Documents, at no cost to Contractor. Contractor shall remove overburden above the level at which Engineer wishes to test and shall fill and re-compact the material after testing is complete.

B. Defective Work:

1. If testing laboratory reports or inspections indicate subgrade, fill, or bedding compaction less than specified density, Contractor shall remove unacceptable materials as necessary and replace with specified materials and provide additional compaction at Contractor's cost until subgrades, bedding, and fill are acceptable.
2. Costs for retesting of subgrade, fill, or bedding materials that did not originally comply with the Contract Documents, including required density, shall be paid by Contractor.

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DIVISION 32

EXTERIOR IMPROVEMENTS

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SECTION 32 13 13
CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Concrete pavement.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 03 05 05 - Testing.
2. Section 03 31 30 - Concrete, Materials and Proportioning.
3. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.

C. Payment Adjustment for Deficient Thickness of Concrete Pavement:

1. A deduction in price shall be made for each lane of concrete pavement 20 feet or more in length, if the average concrete pavement thickness, when determined as provided herein, is within 1 inch tolerance but not within the 1/4 inches tolerance permitted.
   a. Payment reduction formula:

   Payment = (Contract Price) [-2x(d/ts)x(Contract Price)]

   Where d = thickness deficiency determined by coring = ts - ta, but less than 1 inch
   ts = design thickness
   ta = actual thickness determined by coring

2. When any core shows a deficiency of more than 1 inch, the length of adjacent pavement deducted, and for which payment shall be withheld, shall be the sum of the distance, measured parallel to the centerline, from the deficient boring to the nearest borings, in both directions, which show a thickness not more than 1 inch deficient.
3. Deductions in all cases shall be for the full width of the lane which the borings represent.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M153, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction (ASTM D1752).
   b. M171, Standard Specification for Sheet Materials for Curing Concrete (ASTM C1271).
   c. M182, Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats.
   d. M213, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types) (ASTM D1751).
   e. M224, Standard Specification for Use of Protective Sealers for Portland Cement Concrete.
   f. M233, Standard Specification for Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
2. American Concrete Institute (ACI):
   a. 305R, Guide to Hot Weather Concreting.
   b. 306R, Guide to Cold Weather Concreting.
3. ASTM International (ASTM):

a. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
b. A1064/A1064M, Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
c. C33/C33M, Standard Specification for Concrete Aggregates.
d. C150/C150M, Standard Specification for Portland Cement.
e. C174/C174M, Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores.
f. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
g. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 feet-LBF/FT^3 (600 kN-M/M^3)).
h. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
i. D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
j. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
k. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

4. Federal Specification (FS):
   a. SS-S-1614, Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied for Portland Cement and Tar Concrete Pavements (Withdrawn with no replacement).
   b. Concrete installer shall have successfully completed at least three other projects of similar size and type.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
2. Mix design(s) in accordance with Specification Section 03 31 30 and Specification Section 03 05 05.
3. Qualifications of concrete installer.
4. Drawings detailing all reinforcing.
5. Scaled cross section detail of crown template with dimensions showing off sets from level line.
6. Concrete pavement joint pattern for paved areas.
7. Test reports:
   a. Concrete cylinder test results from field quality control.

B. Samples:

1. Samples of fabricated jointing materials and devices.

PART 2 - EXECUTION

2.1 PREPARATION

A. Subgrade Preparation:

1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation and section.
2. Scarify and recompact top 12 inches of fills and embankments which will be under paved areas.

3. Remove soft or spongy areas.
    a. Replace with structural backfill.
    b. Coordinate with Geotechnical Engineer.
4. Compact to the following densities:
    a. Cohesive soils: 95% per ASTM D698.
5. Assure moisture content is within limits prescribed to achieve required compaction density.
6. Following compaction, trim and roll to exact cross section.
    a. Check with approved grading template.
7. Perform density tests on subgrade to determine that subgrade complies with the specification.
8. Coordinate aggregate course with Structural Engineer and Soils/Geotechnical Engineer.

B. Aggregate Course:

1. Place material in not more than 6 inches thick layers.
2. Spread, shape, and compact all material deposited on the subgrade during the same day.
3. Compact to 95% relative per ASTM D4253 and ASTM D4254.

C. Loose and Foreign Material: Remove loose and foreign material immediately before application of paving.

D. Appurtenance Preparation:

1. Block out or box out curb inlets and curb returns.
2. Provide for joint construction as detailed and dimensioned on Drawings.
3. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade.
    a. Secure to elevation with concrete.
    b. Place concrete up to 5 inches below design grade.
4. Headers:
    a. Construct at open ends of pavements.
    b. Use same concrete to construct headers as that used in the abutting structure.
    c. Extend header full width of pavement and crown same as pavement.
5. Clean and oil forms.

2.2 INSTALLATION

A. Concrete Production: Comply with Specification Section 03 31 31.

B. Forms:

1. Form support:
    a. Compact soil foundation and cut to grade to support forms and superimposed machine loads.
    b. Use bearing stakes driven flush with bottom of form to supplement support as necessary.
    c. Do not use earth pedestals.
2. Staking forms:
    a. Joint forms neatly and tightly.
    b. Stake and pin securely with at least three pins for each 10 feet section.
3. Clean and oil forms prior to placement of concrete.
4. Set forms sufficiently in advance of work (minimum of 2 hours) to permit proper inspection.
5. Previously finished concrete pavement, curb or sidewalk contiguous with new work may serve as side form when specifically approved.

C. Reinforcing:

1. Locate longitudinal edge bars between 3 and 6 inches from edge of slab.
2. Lap mats one full space.
3. Tie end transverse member of upper mat securely to prevent curving.
4. Lap nonwelded bars 12 inches minimum.
5. Support:
    a. Place bars and heavy mats securely on chairs at called-for height.
    b. Place other fabric on the first of a two-course pour and cover promptly with final pour, or place fabric by a fabric-placer if procedure is reviewed and approved by Engineer.

D. Joints:

1. Hold joint location and alignment to within +1/4 inches.
2. Finish concrete surface adjacent to previously placed slab to within +1/8 inches, with tooled radius of 1/4 inches.
3. Metal keyway joints:
    a. Form by installing metal joint strip left in place.
    b. Stake and support like side form.
    c. Provide dowels or tie bars.
4. Weakened plane joints:
    a. Tooled joints:
        1) Form groove in freshly placed concrete with tooling device.
        2) Groove dimensions shall be 3/8 inches at surface and 1/4 inches at root.
    b. Sawed joints:
        1) Saw 1/4 inches groove in green concrete.
        2) Commence sawing as soon as concrete is hard enough to withstand operation without chipping, spalling or tearing, regardless of nighttime or weather.
        3) Thoroughly wet surface to protect membrane cure and recoat afterward.
        4) Complete saw cutting before shrinkage stresses cause cracking.
5. Stake in place load transfer device for expansion joints consisting of dowels:
    a. Supporting and spacing means and premolded joint filler as per Drawing details.
    b. Provide preformed joint filler at all junctions with existing curb, sidewalk, steps, or other structures.
6. Install construction joints at end of day's work or wherever concreting must be interrupted for 30 minutes or more.
7. Thoroughly clean and fill joints with joint sealing material as specified.
8. Fill joints without overflowing onto pavement surface.
9. Upper surface of filled joint to be flush to 1/8 inches below finish surface.

E. Place Concrete:

1. Comply with Specification Section 03 31 31.
2. Construct driveway openings, ramps, and other features as per Drawing details.

F. Cold and Hot Weather Concreting:

1. Cold weather:
    a. Cease concrete placing when descending air temperature in shade falls below 40 DEGF.
    b. Do not resume until ambient temperature rises to minimum 40 degrees F.
    c. If placing below 40 degrees F is authorized by Engineer, maintain temperature of mix between 60 and 80 degrees F.
    d. Heat aggregates or water or both.

e. Water temperature may not exceed 175 degrees F.
f. Aggregate temperature may not exceed 150 degrees F.
g. Remove and replace frost damaged concrete.
h. Salt or other antifreeze is not permitted.
i. Comply with ACI 306R.

2. Hot weather:
a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 DEGF.
b. Aggregates or water or both may be cooled.
c. Cool water with crushed ice.
d. Cool aggregates by evaporation of water spray.
e. Never batch cement hotter than 160 degrees F.
f. Comply with ACI 305R.

G. Finishing:

1. As soon as placed, strike off and screed to crown and cross section, slightly above grade, so that consolidation and finishing will bring to final Drawing elevations.
2. Maintain uniform ridge full width with first pass of first screed.
3. Pavement and similar surfaces:
a. Float by longitudinally reciprocating float, passing gradually from edge to edge.
b. Assure successive advances do not exceed half the length of the float.
c. Test level of slab with minimum 10 feet straightedge.
d. Fill depressions with fresh material, consolidate and refinish.
e. Cut down high areas and retest.
f. Belt surface with two-ply canvas belt, using transverse strokes while advancing along center line.
g. Provide final finish by full width burlap or carpet drag, drawn longitudinally.
h. Keep drag clean to avoid build up and consequent scarring.
i. Tool pavement edges with suitable edger.
j. Retest with straightedge and if pavement shows deviation of more than 1/8 inches in 10 feet, remove and replace.

H. Curing:

1. Apply membrane curing compound complying with ASTM C309, and in accordance with manufacturer's directions but at a minimum rate of 200 square feet/GAL.
2. Apply curing compound within 4 hours after finishing or as soon as surface moisture has dissipated.
3. Cure for minimum of seven days.
4. When average daily temperature is below 50 degrees F, provide insulative protection of 12 inches minimum thickness loose dry straw, or equivalent, for 10 days.
5. Linseed oil sealant:
a. Seal surface with linseed oil.
b. Apply linseed oil to clean surface as per AASHTO M224 after concrete has cured for one month.
c. Apply first application at minimum rate of 67 square yards per gallon.
d. Apply second application to a dry surface at minimum rate of 40 square yards per gallon.

I. Protection of Concrete:

1. Protect concrete surfaces and appurtenances from traffic for minimum of 14 days.

2. Erect and maintain warning signs, lights, watchmen to direct traffic.
3. Repair or replace parts of concrete surfaces damaged by traffic, or other causes, occurring prior to final acceptance.
4. Protect concrete pavement against public traffic, construction traffic and traffic caused by employees and agents.
5. No equipment shall be driven or moved across concrete surfaces unless such equipment is rubber-tired and only if concrete is designed for and capable of sustaining loads to be imposed by the equipment.
6. Do not drive over new or existing concrete with tracked vehicles and equipment.

J. Painting and Striping:

1. Stripe and mark pavement per the Drawings following sufficient cure time for pavement.
2. Lay out markings with guidelines, templates, and forms.
3. Apply 6 inches wide stripe with self-contained striping machine to a clean and dry pavement surface.
4. Temperature must be above 40 degrees F and precipitation should not be expected during drying period.
5. Use thermoplastic paint; color as approved by the local reviewing authority for the specific use (i.e., white, yellow, blue) complying with FS TT-P-1952F.
6. Apply at 1 GAL per 105 square feet.

K. Opening to Traffic:

1. After 14 days, pavement may, at Owner's discretion, be opened to traffic if job cured test cylinders have attained a compressive strength of 3,000 pounds per square inch when tested in accordance with ASTM standard methods.
2. Prior to opening to traffic, clean and refill joints as required with the specified filler material.

L. Clean Up:

1. Assure clean up work is completed within two weeks after pavement has been opened to traffic.
2. No new work will begin until clean up work has been completed, or is maintained within two weeks after pavement has been opened to traffic.

M. Pavement Patching:

1. Comply with material and density requirements as mentioned elsewhere in this Specification except provide minimum 6 inches aggregate immediately below the patch.
2. Place pavement patch providing a thickened edge.
3. Assure that patch in plane of "cold" joint has a thickness 6 inches greater than that of the existing pavement.
4. Extend patch under existing pavement for a distance of 6 inches minimum.
5. Fill void under existing pavement with concrete.
6. Undercut existing pavement 6 inches all around patch and to a depth of 6 inches.
7. Prior to placing patch, sawcut edge of existing concrete to 1/4 depth and remove to provide a vertical face for a straight and true joint.

2.3 FIELD QUALITY CONTROL

A. Provide test cylinders in accordance with Specification Section 03 05 05 for concrete placed, as requested by the Quality Assurance Testing Engineer.

B. Pavement Thickness Testing:

1. General:
   a. Core pavement to determine the actual thickness as directed by Engineer.
   b. Determine thickness by ASTM C174/C174M.

c. Fill holes from removal of cores with concrete of the same mixture as specified.

d. Cost incidental to coring of cores showing a deficiency greater than 1/4 inches shall be paid by the Contractor.

e. Cost of cores showing a deficiency of 1/4 inches or less shall be paid by the Owner.

f. If average pavement thickness, as directed by core measurement, is outside specified tolerances, payment will be reduced per PART 1 of this Specification Section.

g. If deficiency in pavement thickness is 1 inch or more, remove and replace pavement at Contractor's expense.

2. Core categories:

a. In determining the average thickness of acceptable pavement for which payment will be made, utilize the following core categories:

CATEGORY NUMBER	CORE THICKNESS IN RELATION TO DESIGN	CORE LENGTH USED IN CALCULATING
1	1 inches or more deficiency	NOT USED
2	Less than 1 inch deficiency through 1/2 inches excess	Actual Core Thickness
3	More than 1/2 inches excess	Design Thickness plus 1/2 inches

b. Core sampling:

1) Take cores in each lane in each block.

c. Take cores at locations where the cement content was found to be low when checking the quantities of cement used during the progress of the work.

d. Each separately poured lane of the pavement to be considered as a unit.

e. A lane shall be considered to be the pavement surface between longitudinal construction joints, between a longitudinal construction joint and the edge, or between two pavement edges in cases where the entire width of the pavement is poured in one operation.

f. Should any core show a deficiency in thickness in excess of 1 inch, check cores shall be taken 5 feet on either side of this location parallel to the centerline of the pavement.

g. If both of these cores are within the 1 inch tolerance, no further special borings for this individual zone of deficiency will be made.

h. If either one or both of these cores are not within the 1 inch tolerance, the procedure will be to cut cores in the following order on either side of the original short core parallel to the centerline of the pavement:

1) 25 feet, 50 feet, the same to be measured from the location of original core found to be deficient in thickness, then at 50 feet intervals until a thickness within the 1 inch tolerance is found in both directions.

2) On either side of the original deficient core, the procedure will then be to make a coring approximately half the distance within the first core which comes within the 1 inch tolerance.

3) Repeat the above procedure until the station (+5 feet), at which the pavement comes within the 1 inch tolerance is located.

4) If for some reason two or more cores are taken at the same station and at least one of them is beyond the 1 inch tolerance, the section of pavement at the station shall be considered as unacceptable.

END OF SECTION

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SECTION 32 92 00
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Seeding, sodding and landscape planting:
    a. Soil preparation.

B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Nursery and Landscape Association/American National Standards Institute (ANLA/ANSI):
    a. Z60.1, American Standard for Nursery Stock.
2. AOAC International (AOAC).
3. ASTM International (ASTM):
    a. D2028, Standard Specification for Cutback Asphalt (Rapid-Curing Type).
    b. D5276, Standard Test Method for Drop Test of Loaded Containers by Free Fall.

B. Quality Control:

1. Fertilizer:
    a. If Engineer determines fertilizer requires sampling and testing to verify quality, testing will be done at Contractor's expense, in accordance with current methods of the AOAC.
    b. Upon completion of Project, a final check of total quantities of fertilizer used will be made against total area seeded.
    c. If minimum rates of application have not been met, Contractor will be required to distribute additional quantities to make up minimum application specified.

1.3 SUBMITTALS

A. Shop Drawings:

1. Layout drawings:
    a. Scaled site plan (scale 1 inch = 20 feet or equal to scale of Project site plan Drawing) on reproducible Drawing to show:
2. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
    c. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
    d. Type of herbicide to be used during first growing season to contain annual weeds and application rate.
    e. Source and location of sod, plants, and plant material.
3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.

B. Informational Submittals:

1. Copies of invoices for fertilizer used on Project showing grade furnished, along with certification of quality and warranty.

1.4 SEQUENCING AND SCHEDULING

A. Installation Schedule:

1. Provide schedule showing when trees, shrubs, groundcovers and other plant materials are anticipated to be planted.
2. Show schedule of when lawn type and other grass areas are anticipated to be planted.
3. Indicate planting schedules in relation to schedule for irrigation system installation, finish grading and topsoiling.
4. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.

B. Pre-installation Meeting:

1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND SUPPLIERS

A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.

2.2 MATERIALS

A. Native Grass Seeding: Certified seed of locally adapted strains.

B. Water:

1. Water free from substances harmful to grass or sod growth.
2. Provide water from source approved prior to use.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

A. General:

1. Limit preparation to areas which will be planted soon after.
2. Provide facilities to protect and safeguard all persons on or about premises.
3. Verify location and existence of all underground utilities.
    a. Take necessary precaution to protect existing utilities from damage due to construction activity.
    b. Repair all damages to utility items at sole expense.
4. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
    a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.

B. Preparation for Lawn-Type Seeding, Sprigging, Plugging or Sodding:

1. Loosen surface to minimum depth of 4 inches.
2. Remove stones over 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter.
3. Prior to applying fertilizer, loosen areas to be seeded with a double disc or other suitable device if the soil has become hard or compacted.
4. Correct any surface irregularities in order to prevent pocket or low areas which will allow water to stand.
5. Distribute fertilizer uniformly over areas to be seeded:

a. For lawn-type seeding: 30 pounds per 1000 square feet.

6. Incorporate fertilizer into soil to a depth of at least 2 inches by disking, harrowing, or other approved methods.
7. Remove stones or other substances from surface which will interfere with turf development or subsequent mowing operations.
8. Grade lawn areas to a smooth, even surface with a loose, uniformly fine texture.
   a. Roll and rake, remove ridges and fill depressions, as required to meet finish grades.
   b. Limit fine grading to areas which can be planted soon after preparation.
9. Restore lawn areas to specified condition if eroded or otherwise disturbed after fine grading and before planting.

3.2 INSTALLATION

A. Lawn-Type and Pasture Seeding:

1. Do not use seed which is wet, moldy, or otherwise damaged.
2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
4. Distribute seed evenly over entire area at rate of application not less than 4 pounds (PLS) of seed per 1000 square feet, 50% sown in one direction, remainder at right angles to first sowing.
5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
   a. Resume work only when favorable conditions develop.
6. Lightly rake seed into soil followed by light rolling or cultipacking.
7. Immediately protect seeded areas against erosion by mulching.
   a. Spread mulch in continuous blanket using 1-1/2 tons per acre to a depth of 4 or 5 straws.
8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer.
   a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
9. Immediately following spreading mulch, anchor mulch using a rolling coulter or a wheatland land packer having wheels with V-shaped edges to force mulch into soil surface.
   a. Use appropriate shields to protect adjacent site improvements.

3.3 MAINTENANCE AND REPLACEMENT

A. General:

1. Begin maintenance of planted areas immediately after each portion is planted and continue until final acceptance or for a specific time period as stated below, whichever is the longer.
2. Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep planted areas uniformly moist as required for proper growth.
3. Protection of new materials:
   a. Provide barricades, coverings or other types of protection necessary to prevent damage to existing improvements indicated to remain.
   b. Repair and pay for all damaged items.
4. Replace unacceptable materials with materials and methods identical to the original specifications unless otherwise approved by the Engineer.

B. Seeded or Sodded Lawns:

1. Maintain seeded lawns. Maintenance period begins at completion of planting or installation of entire area to be seeded or sodded.
2. Engineer will review seeded or sodded lawn area after installation for initial acceptance.
3. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading, and replanting as required to establish a smooth, uniform lawn, free of weeds and eroded or bare areas.
4. Lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas.
    a. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch.
5. Mow lawns as soon as there is enough top growth to cut with mower set at recommended height for principal species planted.
    a. Repeat mowing as required to maintain height.
    b. Do not delay mowing until grass blades bend over and become matted.
    c. Do not mow when grass is wet.
    d. Time initial and subsequent mowings as required to maintain a height of 1-1/2 to 2 inches.
    e. Do not mow lower than 1-1/2 inches.
6. Remulch with new mulch in areas where mulch has been disturbed by wind or maintenance operations sufficiently to nullify its purpose.
    a. Anchor as required to prevent displacement.
7. Unacceptable plantings are those areas that do not meet the quality of the specified material, produce the specified results, or were not installed to the specified methods.
8. Engineer will review final acceptability of installed areas at end of maintenance period.
9. Maintain repaired areas until remainder of maintenance period or approved by Engineer, whichever is the longer period.

END OF SECTION

DIVISION 33

UTILITIES

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SECTION 33 40 00
STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 31 23 33 - Trenching and Backfilling.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M36, Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760/A760M).
   b. M190, Standard Specification for Bituminous-Coated Corrugated Metal Culvert Pipe and Pipe Arches.
2. ASTM International (ASTM):
   a. A760/A760M, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
   b. C14, Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe.
   c. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
   d. C361, Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.
   e. F2510/F2510M, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Corrugated Dual- and Triple-Wall Polyethylene and Polypropylene Pipes.
   f. F2648/F2648M, Standard Specification for 2 to 60 inches (50 to 1500 mm) Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

1.3 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.

B. Submit schedules and details for structures and joints.

PART 2 - EXECUTION

2.1 PREPARATION

A. Comply with Specification Section 31 23 33.

2.2 INSTALLATION

A. Grade all surfaces to drain away from project area, and not on to adjoining property.

B. Overall site drainage is to the south.

2.3 FIELD QUALITY CONTROL

A. In case of conflict, do not relocate piping or drainageways without prior approval from the Engineer.

END OF SECTION

DIVISION 40

PROCESS INTERCONNECTIONS

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SECTION 40 05 00

PIPE AND PIPE FITTINGS - BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Process piping systems.
2. Utility piping systems.
3. Plumbing piping systems.

B. Related Specification Sections include but are not necessarily limited to:

1. Section 31 23 33 - Trenching and Backfilling.
2. Section 40 05 51 - Common Requirements for Process and Utility Valves.

1.2 QUALITY ASSURANCE

A. Referenced Standards:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M36, Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains (Equivalent ASTM A760).
   b. M190, Standard Specification for Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.
   c. M252, Standard Specification for Corrugated Polyethylene Drainage Tubing.
   d. M294, Interim Specification for Corrugated Polyethylene Pipe 12 to 24 Inch Diameter.
2. American Iron and Steel Institute (AISI).
3. American Society of Mechanical Engineers (ASME):
   a. B16.3, Malleable Iron Threaded Fittings.
   b. B16.5, Pipe Flanges and Flanged Fittings.
   c. B16.9, Factory-Made Wrought Steel Butt-Welding Fittings.
   d. B16.22, Wrought Copper and Bronze Solder - Joint Pressure Fittings.
   e. B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
   f. B36.19, Stainless Steel Pipe.
   g. B40.100, Pressure Gauges and Gauge Attachments.
4. ASTM International (ASTM):
   a. A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   b. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
   c. A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
   d. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   e. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   f. A197, Standard Specification for Cupola Malleable Iron.
   g. A234, Standard Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
   h. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

i. A312, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
j. A518, Standard Specification for Corrosion-Resistant High-Silicon Iron Castings.
k. A536, Standard Specification for Ductile Iron Castings.
l. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
m. A760, Standard Specification for Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains.
n. A774, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
o. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
p. B88, Standard Specification for Seamless Copper Water Tube.
q. C14, Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.
r. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
s. C425, Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings.
t. C443, Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
u. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
v. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength and Perforated.
w. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
x. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
y. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
z. D4101, Standard Specification for Polypropylene Plastic Injection and Extrusion Materials.
aa. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
bb. F441, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

5. American Water Works Association (AWWA):
   a. B300, Standard for Hypochlorites.
   b. C200, Standard for Steel Water Pipe - 6 inches and Larger.
   c. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 inches through 144 inches.
   d. C208, Standard for Dimensions for Fabricated Steel Water Pipe Fittings.
   e. C606, Standard for Grooved and Shouldered Joints.
   f. C651, Standard for Disinfecting Water Mains.
   g. C800, Standard for Underground Service Line Valves and Fittings.
6. American Water Works Association/American National Standards Institute (AWWA/ANSI):
   a. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
   b. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   c. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.

d. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.
e. C153/A21.53, Standard for Ductile-Iron Compact Fittings for Water Service.

7. Chlorine Institute, Inc. (CI):
   a. Pamphlet 6, Piping Systems for Dry Chlorine.
8. Cast Iron Soil Pipe Institute (CISPI):
   a. 301, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
9. International Plumbing Code (IPC).
10. National Fire Protection Association (NFPA):
    a. 54, National Fuel Gas Code.
    b. 69, Standard on Explosion Prevention Systems.
11. Underwriters Laboratories, Inc. (UL).

B. Coordinate flange dimensions and drillings between piping, valves, and equipment.

1.3 DEFINITIONS

A. Hazardous Gas Systems: Digester gas, chlorine gas, sulfur dioxide gas, carbon dioxide gas, lab gases.

B. HPIC: High performance industrial coating.

C. PVDF: Polyvinylidene fluoride.

1.4 SYSTEM DESCRIPTION

A. Piping Systems Organization and Definition:

1. Piping services are grouped into designated systems according to the chemical and physical properties of the fluid conveyed, system pressure, piping size and system materials of construction.

1.5 SUBMITTALS

A. Shop Drawings:

1. Product technical data including:
   a. Acknowledgement that products submitted meet requirements of standards referenced.
   b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
   c. Separate schedule sheet for each piping system scheduled in this Specification Section showing compliance of all system components.
      1) Attach technical product data on gaskets, pipe, fittings, and other components.
2. Fabrication and/or Layout Drawings:
   a. Exterior yard piping drawings (minimum scale 1 inch equals 10 feet) with information including:
      1) Dimensions of piping lengths.
      2) Invert or centerline elevations of piping crossings.
      3) Acknowledgement of bury depth requirements.
      4) Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
      5) Acknowledge designated valve or gate tag numbers, manhole numbers, instrument tag numbers, pipe and line numbers.
      6) Line slopes and vents.
   b. Interior piping drawings (minimum scale 1/8 inches equals 1 foot) with information including:
      1) Dimensions of piping from column lines or wall surfaces.

2) Invert dimensions of piping.
3) Centerline elevation and size of intersecting ductwork, conduit/conduit racks, or other potential interferences requiring coordination.
4) Location and type of pipe supports and anchors.
5) Locations of valves and valve actuator type.
6) Details of fittings, tapping locations, equipment connections, flexible expansion joints, connections to equipment, and related appurtenances.
7) Acknowledgement of valve, equipment and instrument tag numbers.
8) Provisions for expansion and contraction.
9) Line slopes and air release vents.
10) Rough-in data for plumbing fixtures.

c. Schedule of interconnections to existing piping and method of connection.

B. Informational Submittals:

1. Qualifications of lab performing disinfection analysis on water systems.
2. Test reports:
   a. Copies of pressure test results on all piping systems.
   b. Reports defining results of dielectric testing and corrective action taken.
   c. Disinfection test report.
   d. Notification of time and date of piping pressure tests.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect pipe coating during handling using methods recommended by manufacturer.

1. Use of bare cables, chains, hooks, metal bars or narrow skids in contact with coated pipe is not permitted.

B. Prevent damage to pipe during transit.

1. Repair abrasions, scars, and blemishes.
2. If repair of satisfactory quality cannot be achieved, replace damaged material immediately.

PART 2 - PRODUCTS

2.1 PIPING SYSTEMS SCHEDULE

A. Piping system materials, fittings and appurtenances are subject to requirements of specific piping systems schedule per the Drawings.

2.2 COMPONENTS AND ACCESSORIES

A. Reducers:

1. Furnish appropriate size reducers and reducing fittings to mate pipe to equipment connections.
2. Connection size requirements may change from those shown on Drawings depending on equipment furnished.

B. Protective Coating and Lining:

1. Include pipe, fittings, and appurtenances where coatings, linings, coating, tests and other items are specified.
2. Piping systems scheduled in the PIPING SYSTEM SCHEDULES Article of this Section that are indicated to receive HPIC shall receive surface preparation and primer applied in the fabrication facility, at the coating applicator's shop, or other off-site location acceptable to the Engineer. Intermediate and topcoats are to be field applied unless noted otherwise.

C. Underground Warning Tape:

1. Install with all underground piping.
2. Couplers:
    a. Built-in valve and spring loaded poppet which close automatically when disconnected.
    b. Designed to remain with only one arm locked in closed position.
    c. Construct couplers for sludge applications fabricated from material utilized for adapters.
    d. Construct couplers for chemical and PVC system applications 3 inches and less from polypropylene with stainless steel arms and pins.
        1) Above 3 inches, provide stainless steel units.
    e. Gasket: Compatible with conveyed liquid.
3. Dust caps: For all adapters.

D. Valves:

1. See schematics and details for definition of manual valves used in each system under 4 inches in size.
    a. See Drawings schedule for valve types 4 inches and above and for automatic valves used in each system.

PART 3 - EXECUTION

3.1 EXTERIOR BURIED PIPING INSTALLATION

A. Unless otherwise shown on the Drawings, provide a minimum of 5 feet and maximum of 8 feet earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions subject to freezing.

B. Enter and exit through structure walls, floors, and ceilings by using penetrations and seals and as shown on Drawings.

C. When entering or leaving structures with buried joint piping, install joint within 2 feet of point where pipe enters or leaves structure.

1. Install second joint not more than 6 feet nor less than 4 feet from first joint.

D. Install expansion devices as necessary to allow expansion and contraction movement.

E. Laying Pipe In Trench:

1. Excavate and backfill trench in accordance with Specification Section 31 23 33.
2. Clean each pipe length thoroughly and inspect for compliance to specifications.
3. Grade trench bottom and excavate for pipe bell and lay pipe on trench bottom.
4. Install gasket or joint material according to manufacturer's directions after joints have been thoroughly cleaned and examined.
5. Except for first two joints, before making final connections of joints, install two full sections of pipe with earth tamped alongside of pipe or final with bedding material placed.
6. Lay pipe in only suitable weather with good trench conditions.
    a. Never lay pipe in water except where approved by Engineer.
7. Seal open end of line with watertight plug if pipe laying stopped.
8. Remove water in trench before removal of plug.

F. Lining Up Push-On Joint Piping:

1. Lay piping on route lines shown on Drawings.
2. Deflect from straight alignments or grades by vertical or horizontal curves or offsets.
3. Observe maximum deflection values stated in manufacturer's written literature.
4. Provide special bends when specified or where required alignment exceeds allowable deflections stipulated.

5. Install shorter lengths of pipe in such length and number that angular deflection of any joint, as represented by specified maximum deflection, is not exceeded.

G. Anchorage and Blocking:

1. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by forces in or on buried piping tees, wye branches, plugs, or bends.
2. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall.
   a. Concrete blocks shall not cover pipe joints.
3. Provide bearing area of concrete in accordance with drawing detail.

H. Install underground hazard warning tape per Specification Section 10 14 00.

I. Install insulating components where dissimilar metals are joined together.

3.2 INTERIOR AND EXPOSED EXTERIOR PIPING INSTALLATION

A. Install piping in vertical and horizontal alignment as shown on Drawings.

B. Alignment of piping smaller than 4 inches may not be shown; however, install according to Drawing intent and with clearance and allowance for:

1. Expansion and contraction.
2. Operation and access to equipment, doors, windows, hoists, moving equipment.
3. Headroom and walking space for working areas and aisles.
4. System drainage and air removal.

C. Enter and exit through structure walls, floor and ceilings using penetrations and seals specified as shown on the Drawings.

D. Install vertical piping runs plumb and horizontal piping runs parallel with structure walls.

E. Pipe Support:

1. Use methods of piping support as shown on Drawings.
2. Where pipes run parallel and at same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight.
   a. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
3. Size pipe supports with consideration to specific gravity of liquid being piped.

F. Locate and size sleeves and castings required for piping system.

1. Arrange for chases, recesses, inserts or anchors at proper elevation and location.

G. Use reducing fittings throughout piping systems.

1. Bushings will not be allowed unless specifically approved.

H. Equipment Drainage and Miscellaneous Piping:

1. Provide drip pans and piping at equipment where condensation may occur.
2. Hard pipe stuffing box leakage to nearest floor drain.
3. Avoid piping over electrical components such as motor control centers, panelboards, etc.
   a. If piping must be so routed, utilize 16 GA, 316 stainless steel drip pan under piping and over full length of electrical equipment.
   b. Hard pipe drainage to nearest floor drain.
4. Collect system condensate at drip pockets, traps and blowoff valves.
5. Provide drainage for process piping at locations shown on Drawings in accordance with Drawing details.

6. For applications defined above and for other miscellaneous piping which is not addressed by a specific piping service category provide 304 stainless steel piping and fittings.
    a. Size to handle application with 3/4 inches being minimum size provided.

I. Unions:

1. Install in position which will permit valve or equipment to be removed without dismantling adjacent piping.
2. Mechanical type couplings may serve as unions.
3. Additional flange unions are not required at flanged connections.

J. Install expansion devices as necessary to allow expansion/contraction movement.

K. Provide full face gaskets on all systems.

L. Anchorage and Blocking:

1. Block, anchor, or harness exposed piping subjected to forces in which joints are installed to prevent separation of joints and transmission of stress into equipment or structural components not designed to resist those stresses.

M. Equipment Pipe Connections:

1. Equipment - General:
    a. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges.
    b. Where push-on joints are used in conjunction with flanged joints, final positioning of push-on joints shall not be made until flange joints have been tightened without strain.
    c. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint.
        1) Provide tightening torque in accordance with manufacturer's recommendations.
    d. Support and match flange faces to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
    e. Permit piping connected to equipment to freely move in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened.
    f. Align, level, and wedge equipment into place during fitting and alignment of connecting piping.
    g. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment.
    h. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four bolts per joint installed and tightened.
        1) Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange.
        2) Realign as necessary, install flange bolts and make equipment connection.
    i. Provide utility connections to equipment shown on Drawings, scheduled or specified.
2. Plumbing and HVAC equipment:
    a. Make piping connections to plumbing and HVAC equipment, including but not limited to installation of fittings, strainers, pressure reducing valves, flow control valves and relief valves provided with or as integral part of equipment.
    b. Furnish and install sinks, fittings, strainers, pressure reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or as integral part of equipment.
    c. For each water supply piping connection to equipment, furnish and install union and gate or angle valve.
        1) Provide wheel handle stop valve at each laboratory sink water supply.

2) Minimum size: 1/2 inches.

d. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly to building sewer system.

1) Size trap as required by IPC.

e. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed.

N. Provide insulating components where dissimilar metals are joined together.

O. Instrument Connections:

1. See drawing details.

3.3 CONNECTIONS WITH EXISTING PIPING

A. Where connection between new work and existing work is made, use suitable and proper fittings to suit conditions encountered.

B. Perform connections with existing piping at time and under conditions which will least interfere with service to customers affected by such operation.

C. Undertake connections in fashion which will disturb system as little as possible.

D. Provide suitable equipment and facilities to dewater, drain, and dispose of liquid removed without damage to adjacent property.

E. Where connections to existing systems necessitate employment of past installation methods not currently part of trade practice, utilize necessary special piping components.

F. Where connection involves potable water systems, provide disinfection methods as prescribed in this Specification Section.

G. Once tie-in to each existing system is initiated, continue work continuously until tie-in is made and tested.

3.4 ACCESS PROVISIONS

A. Provide access doors or panels in walls, floors, and ceilings to permit access to valves, piping and piping appurtenances requiring service.

B. Size of access panels to allow inspection and removal of items served, minimum 10 x 14 inches size.

3.5 CATHODIC PROTECTION

A. Isolate, dielectrically, all piping from all other metals including reinforcing bars in concrete slabs, other pipe lines, and miscellaneous metal.

B. Make all connections from wire or cable by Thermit Cadwelding accomplished by operators experienced in this process.

C. Install all cables with a loop and overhead knot around each pipe and slack equal to at least 50% of the straight line length.

D. After cadwelding, coat all exposed metallic surfaces with hot applied tape.

3.6 PRESSURE GAGES

A. Provide at locations shown on the Drawings and specified.

3.7 FIELD QUALITY CONTROL

A. Pipe Testing - General:

1. Test piping systems as follows:

a. Test exposed, non-insulated piping systems upon completion of system.

b. Test exposed, insulated piping systems upon completion of system but prior to application of insulation.

c. Test concealed interior piping systems prior to concealment and, if system is insulated, prior to application of insulation.

d. Test buried piping (insulated and non-insulated) prior to backfilling and, if insulated, prior to application of insulation.

2. Isolate equipment which may be damaged by the specified pressure test conditions.

3. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates.

a. Select each gage so that the specified test pressure falls within the upper half of the gage's range.

b. Notify the Engineer 24 hours prior to each test.

4. Completely assemble and test new piping systems prior to connection to existing pipe systems.

5. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.

6. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

B. Pressure Testing:

1. Testing medium: Unless otherwise specified utilize the following test media.

a. Process systems:

PIPE LINE SIZE	SPECIFIED TEST PRESSURE	TESTING MEDIUM
2 inches and smaller	75 psi or less	Water
2 inches and smaller	Greater than 75 psi	Water
Greater than 2 inches	3 psi or less	Water
Greater than 2 inches	Greater than 3 psi	Water

b. Liquid systems:

PIPE LINE SIZE (DIA)	GRAVITY OR PUMPED	SPECIFIED TEST PRESSURE	TESTING MEDIUM
Up to and including 48 inches	Gravity	25 psiG or less	Water
Above 48 inches	Gravity	25 psiG or less	Water
All sizes	Pumped	250 psiG or less	Water

2. Allowable leakage rates:

a. All exposed piping systems, all pressure piping systems and all buried, insulated piping systems which are hydrostatically pressure tested shall have zero leakage goal at the specified test pressure throughout the duration of the test.

b. Hydrostatic exfiltration and infiltration for sanitary and stormwater sewers (groundwater level is below the top of pipe):

1) Leakage rate: 200 GAL per inch diameter per mile of pipe per day at average head on test section of 3 feet.

2) Average head is defined from groundwater elevation to average pipe crown.

3) Acceptable test head leakage rate for heads greater than 3 feet: Acceptable leakage rate (gallons per inch diameter per mile per day) equals 115 by (actual test head to the 1/2 power).

c. Hydrostatic infiltration test for sanitary and stormwater sewers (groundwater level is above the top of pipe):
   1) Allowable leakage rate: 200 GAL per inch diameter per mile of pipe per day when depth of groundwater over top of pipe is 2 to 6 feet.
   2) Leakage rate at heads greater than 6 feet: Allowable leakage rate (gallons per inch diameter per mile of pipe per day) equals 82 by (actual head to the 1/2 power).

d. Non-hazardous gas and air systems which are tested with air shall have a maximum pressure drop of 5% of the specified test pressure throughout the duration of the test.

e. For low pressure (less than 25 psiG) air testing, the acceptable time for loss of 1 psiG of air pressure shall be:

PIPE SIZE (IN DIA)	TIME, MINUTES/100 feet
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3
48	7.6

3. Hydrostatic pressure testing methodology:
   a. General:
      1) All joints, including welds, are to be left exposed for examination during the test.
      2) Provide additional temporary supports for piping systems designed for vapor or gas to support the weight of the test water.
      3) Provide temporary restraints for expansion joints for additional pressure load under test.
      4) Isolate equipment in piping system with rated pressure lower than pipe test pressure.
      5) Do not coat or insulate exposed piping until successful performance of pressure test.
   b. Soil, waste, drain and vent systems:
      1) Test at completion of installation of each stack or section of piping by filling system with water and checking joints and fittings for leaks.
      2) Eliminate leaks before proceeding with work or concealing piping.

3) Minimum test heights shall be 10 feet above highest stack inlet.

4. Air testing methodology:
   a. General:
      1) Assure air is ambient temperature.
   b. Low pressure air testing:
      1) Place plugs in line and inflate to manufacturer's designated seal pressure.
      2) Check plugs for proper sealing.
      3) Introduce low pressure air into sealed line segment until air pressure reaches 4 psiG greater than ground water or allowable limits of ASTM F1417.
         a) Use test gage conforming to ASME B40.100 with 0 to 15 psi scale and accuracy of 1% of full range.
      4) Allow 2 minutes for air pressure to stabilize.
      5) After stabilization period (3.5 psiG minimum pressure in pipe) discontinue air supply to line segment.
      6) Record pressure at beginning and end of test.

3.8 CLEANING, DISINFECTION AND PURGING

A. Cleaning:

1. Clean interior of piping systems thoroughly before installing.
2. Maintain pipe in clean condition during installation.
3. Before jointing piping, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
   a. Pig high pressure air piping before connecting to valves or instruments.
4. At completion of work and prior to Final Acceptance, thoroughly clean work installed under these Specifications.
   a. Clean equipment, fixtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing, or from other causes.
   b. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.
5. After erection of piping and tubing, but prior to installation of service outlet valves, blow natural gas systems clear of free moisture and foreign matter by means of air, nitrogen or carbon dioxide.
   a. Oxygen shall never be used.
6. Clean chlorine piping in accordance with CI Pamphlet 6.
7. Purge all neat liquid polymer tubing or piping between the neat polymer storage tank or tote and the polymer blending units with mineral oil to remove residual water prior to introducing neat polymer. Following purging, drain as much of the mineral oil out of the system as possible. Dispose of purged fluids and waste mineral oil in accordance with local environmental regulations.

B. Disinfection of Potable Water Systems:

1. After favorable performance of pressure test and prior to Final Acceptance, thoroughly flush entire potable water piping system including supply, source and any appurtenant devices and perform disinfection as prescribed.
2. Perform work, including preventative measures during construction, in full compliance with AWWA C651.
3. Perform disinfection using sodium hypochlorite complying with AWWA B300.
4. Flush each segment of system to provide flushing velocity of not less than 2.5 feet per second.
5. Drain flushing water to sanitary sewer.

a. Do not drain flushing water to receiving stream.

6. Use continuous feed method of application.
   a. Tag system during disinfection procedure to prevent use.
7. After required contact period, flush system to remove traces of heavily chlorinated water.
8. After final flushing and before placing water in service, obtain an independent laboratory approved by the Owner to collect samples and test for bacteriological quality.
   a. Repeat entire disinfection procedures until satisfactory results are obtained.
9. Secure and deliver to Owner, satisfactory bacteriological reports on samples taken from system.
   a. Ensure sampling and testing procedures are in full compliance to AWWA C651, local water purveyor and applicable requirements of State of Iowa.

3.9 LOCATION OF BURIED OBSTACLES

A. Furnish exact location and description of buried utilities encountered and thrust block placement.

B. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants and related fixed structures.

C. Include such information as location, elevation, coverage, supports and additional pertinent information.

D. Incorporate information on "As-Recorded" Drawings.

3.10 PIPE INSULATION

A. Insulate pipe and pipe fittings to protect from freezing.

3.11 SERVICE SYSTEM SUMMARY

A. Service Systems as defined in the Drawings.

END OF SECTION

SECTION 40 05 51

COMMON REQUIREMENTS FOR PROCESS AND UTILITY VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Valving and valving appurtenances.

B. Related Sections include but are not necessarily limited to:

1. Section 40 05 00 - Pipe and Pipe Fittings - Basic Requirements.

1.2 REFERENCES

A. Definitions:

1. The following are definitions of abbreviations used in this Specification Section or one of the individual valve sections:
   a. CWP: Cold water working pressure.
   b. SWP: Steam working pressure.
   c. WOG: Water, oil, gas working pressure.
   d. WWP: Water working pressure.

B. Referenced Standards:

1. American Society of Mechanical Engineers (ASME):
   a. B1.20.1, Pipe Threads, General Purpose.
   b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   c. B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
2. ASTM International (ASTM):
   a. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   b. D256, Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
   c. D638, Standard Test Method for Tensile Properties of Plastics.
   d. D648, Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position.
   e. D695, Standard Test Method for Compressive Properties of Rigid Plastics.
   f. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
3. American Water Works Association (AWWA):
   a. C207, Standard for Steel Pipe Flanges for Waterworks Service - Sizes 4 inches through 144 inches.
   b. C500, Standard for Metal-Seated Gate Valves for Water Supply Service.
   c. C504, Standard for Rubber-Seated Butterfly Valves.
   d. C507, Standard for Ball Valves, 6 inches through 48 inches (150 mm through 1200 mm).
   e. C509, Standard for Resilient-Seated Gate Valves for Water Supply Service.
   f. C550, Standard for Protective Coatings for Valves and Hydrants.
   g. C606, Standard for Grooved and Shouldered Joints.
4. American Water Works Association/American National Standards Institute (AWWA/ANSI):
   a. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

5. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
    b. MG 1, Motors and Generators.
6. National Fire Protection Association (NFPA):
    a. 70, National Electrical Code (NEC).

1.3 SUBMITTALS

A. Action Submittals:

1. Product technical data including:
    a. Acknowledgement that products submitted meet requirements of standards referenced.
    b. Manufacturer's installation instructions.
    c. Valve pressure and temperature rating.
    d. Valve material of construction.
    e. Special linings.
    f. Valve dimensions and weight.
    g. Valve flow coefficient.

B. Informational Submittals:

1. Test reports if required in the individual valve specification.

C. Closeout Submittals:

1. Operation and Maintenance Data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, refer to individual valve Specification Sections for acceptable manufacturers.

2.2 MATERIALS

A. Refer to individual valve Specification Sections.

2.3 FABRICATION

A. End Connections:

1. Provide the type of end connections for valves as required on the Drawings.
2. Comply with the following standards:
    a. Threaded: ASME B1.20.1.
    b. Flanged: ASME B16.1, Class 125 unless otherwise noted or AWWA C207.
    c. Bell and spigot or mechanical (gland) type: AWWA/ANSI C111/A21.11.
    d. Soldered: ASME B16.18.
    e. Grooved: Rigid joints per Table 5 of AWWA C606.

B. Nuts, Bolts, and Washers:

1. Wetted or internal to be bronze or stainless steel.
    a. Exposed to be zinc or cadmium plated.
2. Buried:
    a. T-Bolts for mechanical joints: Per AWWA/ANSI C111/A21.1
    b. Other bolts and nuts: ASTM A307
3. Heads and dimensions per ASME B1.1.
4. Threaded per ASME B1.1.

5. Project ends 1/4 to 1/2 inches beyond nuts.

C. On Insulated Piping: Provide valves with extended stems to permit proper insulation application without interference from handle.

D. Epoxy Interior Coating: Provide epoxy interior coating for all ferrous surfaces in accordance with AWWA C550.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Setting Buried Valves:

1. Locate valves installed in pipe trenches where buried pipe indicated on Drawings.
2. Set valves and valve boxes plumb.
3. Place valve boxes directly over valves with top of box being brought to surface of finished grade.
4. Install in closed position.
5. Place valve on firm footing in trench to prevent settling and excessive strain on connection to pipe.
6. After installation, backfill up to top of box for a minimum distance of 4 feet on each side of box.

C. Support exposed valves and piping adjacent to valves independently to eliminate pipe loads being transferred to valve and valve loads being transferred to the piping.

D. For grooved coupling valves, install rigid type.

E. Wax Tape Coating System:

1. After installation, coat all buried nuts and bolts with a wax tape coating system in accordance with:
   a. AWWA C217
   b. Manufacturer’s printed instructions.
2. Cut strips of wax tape and apply them around all bolts and nuts so that there are no voids or spaces under the tape.
3. Apply a sufficient amount of tape to completely encapsulate all bare metal.

F. For threaded valves, provide union on one side within 2 feet of valve to allow valve removal.

G. Install valves accessible for operation, inspection, and maintenance.

3.2 FIELD QUALITY CONTROL

A. Wax Tape Coating Testing:

1. Inspect each wax tape-wrapped component.
   a. Verify primer was applied to substrate surfaces.
   b. Ensure the wax tape has fully encapsulated all portions of the substrate.
   c. Ensure that the wax tape is in intimate contact with the substrate.
   d. Verify that the wax tape has been applied to the specified thickness.
2. Do not backfill until this inspection is complete and the wax tape application is approved by the Engineer.

END OF SECTION

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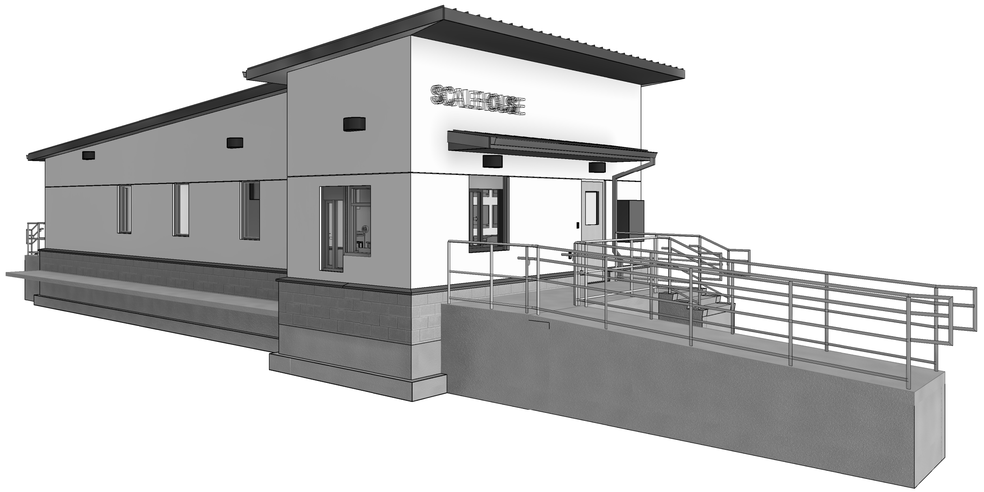
Metro Waste Authority



Contract Drawings For

METRO PARK WEST SCALE HOUSE DESIGN

METRO WASTE AUTHORITY
PROJECT P-66

Project No. 10386668

Date: 06/14/2024

MWA MPW SCALE HOUSE SHEET INDEX

SHEET #	DESCRIPTION
G-000	COVER SHEET
G-001	SHEET INDEX
G-002	ABBREVIATIONS
G-003	GENERAL LEGEND
G-004	CIVIL LEGEND AND GENERAL NOTES
G-005	MECHANICAL LEGEND
G-006	ELECTRICAL LEGEND
G-102	CODE ANALYSIS
G-103	LIFE SAFETY
C-101	EXISTING CONDITIONS PLAN
C-102	SITE IMPROVEMENTS PLAN
C-103	GRADING PLAN
C-501	CIVIL DETAILS
S-001	STRUCTURAL NOTES
S-101	STRUCTURAL FOUNDATION PLAN
S-102	STRUCTURAL ROOF FRAMING PLAN
S-301	STRUCTURAL SECTIONS
S-501	TYPICAL STRUCTURAL DETAILS
S-502	TYPICAL STRUCTURAL DETAILS
S-503	STRUCTURAL DETAILS
A-102	ARCHITECTURE PLAN
A-103	ARCHITECTURE ROOF PLAN
A-104	ARCHITECTURE REFLECTED CEILING PLAN
A-201	ARCHITECTURE EXTERIOR ELEVATIONS
A-202	ARCHITECTURE INTERIOR ELEVATIONS & SECTIONS
A-301	ARCHITECTURE BUILDING SECTIONS
A-302	ARCHITECTURE WALL SECTIONS
A-501	ARCHITECTURE DETAILS
A-502	ARCHITECTURE DETAILS
A-601	ARCHITECTURE SCHEDULES
A-602	ARCHITECTURE INTERIOR FINISHES
P-100	PLUMBING PLAN
P-101	PLUMBING PLAN
P-501	PLUMBING DETAILS
P-601	PLUMBING SCHEDULES AND DIAGRAMS
M-101	HVAC PLAN
M-501	HVAC DETAILS
M-601	HVAC SCHEDULES
E-001	ELECTRICAL SITE PLAN
E-101	ELECTRICAL POWER AND SYSTEMS PLAN
E-111	ELECTRICAL LIGHTING PLAN
E-501	ELECTRICAL DETAILS
E-601	ELECTRICAL ONE-LINE RISER DIAGRAM AND PANEL SCHEDULE
E-602	ELECTRICAL SCHEDULES

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

GENERAL
SHEET INDEX

0 1" 2"

FILENAME 10386668-G.rvt

SCALE

SHEET
G-001

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A/C	AIR CONDITIONING
A/E	ARCHITECT/ENGINEER
A	AMPERE
AB	ANCHOR BOLT
ABAN	ABANDON
ABC	AGGREGATE BASE COURSE
ABT	ABOUT
AC	ALTERNATING CURRENT
ACK	ACKNOWLEDGE
ACP	ACOUSTIC CEILING PANEL, ASPHALTIC CONCRETE PAVEMENT
ACST	ACOUSTIC
AD	ADDENDUM, AREA DRAIN
ADDL	ADDITIONAL
ADH	ADHESIVE
ADJ	ADJUSTABLE, ADJACENT
AF	AMP FRAME, AMP FUSE
AFF	ABOVE FINISH FLOOR
AFG	ABOVE FINISH GRADE
AGGR	AGGREGATE
AI	AREA INLET, ANALOG INPUT
AIC	AMPS INTERRUPTING CAPACITY
ALIG	ALIGNMENT
ALT	ALTERNATE, ALTITUDE
ALUM	ALUMINUM
AM	ACOUSTICAL MATERIAL
AMB	AMBIENT
ANC	ANCHOR
AO	ANALOG OUTPUT
AP	ACCESS PANEL
APRX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
ASSY	ASSEMBLY
AT	ACOUSTICAL TILE, AMP TRIP
ATC	ACOUSTICAL TILE CEILING
ATM	ATMOSPHERE AUTO AUTOMATIC
AUX	AUXILIARY
AVE	AVENUE
AVG	AVERAGE
AWG	AMERICAN WIRE GAGE
AWT	ACOUSTICAL WALL TILE
B TO B	BACK-TO-BACK
BAL	BALANCE
BBD	BULLETIN BOARD
BC	BASE CABINET, BOTTOM CHORD, BOLT CENTER, BOLT CIRCLE
BD	BOARD
BE	BOTH ENDS, BELL END
BF	BOTH FACES, BOTTOM FACE, BLIND FLANGE, BOARD FEET
BITUM	BITUMINOUS
BKG	BACKING
BL	BASE LINE
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BENCHMARK, BEAM
BOC	BACK OF CURB
BOD	BOTTOM OF DUCT
BOG	BOTTOM OF GRILLE
BOL	BOTTOM OF LOUVER, BOLLARD
BOP	BOTTOM OF PIPE
BOR	BOTTOM OF REGISTER
BOT	BOTTOM
BOU	BOTTOM OF UNIT
BP	BASE PLATE
BRG	BEARING
BRGP	BEARING PLATE
BRKT	BRACKET
BS	BOTH SIDES
BTU	BRITISH THERMAL UNIT
BTW	BETWEEN
BTWLD	BUTT WELD
BU	BELL UP, BUILT-UP
BUR	BUILT-UP ROOFING
BW	BOTH WAYS
BYP	BYPASS
CTOC	CENTER TO CENTER
C&G	CURB AND GUTTER
C	CHANNEL SHAPE, CENTIGRADE, CONDUIT
CAB	CABINET
CAP	CAPACITY
CAT	CATALOG, CATALOGIORY
CAV	CAVITY
CB	CATCH BASIN
CCB	CONCRETE BLOCK
CCW	COUNTER CLOCKWISE
CDF	CONTROLLED-DENSITY FILL
CE	CONCRETE EDGE
CER	CERAMIC
CF	CUBIC FEET (FOOT)
CFL	COUNTER FLASHING
CHBD	CHALKBOARD
CHD	CHORD
CHFR	CHAMFER
CHH	COMMUNICATION HANDHOLE
CI	CURB INLET
CIP	CAST-IN-PLACE
CIPB	CONCRETE INTERLOCKING PAVER BALLAST
CIRC	CIRCULATION, CIRCULAR
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL	CENTERLINE, CLASS, CLOSE
CLG	CEILING
CLKG	CAULKING
CLR	CLEAR
CMH	COMMUNICATION MANHOLE
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CO	CLEANOUT, CONCRETE OPENING
COL	COLUMN
COM	COMMON
COMB	COMBINATION
COMM	COMMUNICATION
COMP	COMPOSITION, COMPRESSIBLE, COMPOSITE
CON	CONCENTRIC
CONC	CONCRETE
CONN	CONNECTION
CONST	CONSTRUCTION

CONT	CONTINUOUS
COOR	COORDINATE
CORR	CORROSIVE, CORRUGATED
CP	CHECKER PLATE, CONTROL POINT
CPLG	COUPLING
CRL	CORROSION-RESISTANT LINING
CSC	COMPRESSION SLEEVE COUPLING
CSK	COUNTERSINK
CSS	CLINIC SERVICE SINK
CT	CERAMIC TILE
CTJ	CONTRACTION JOINT
CTR	CENTER
CTRL	CONTROL
CVT	CULVERT
CU	COPPER, CUBIC
CW	CLOCKWISE
CY	CUBIC YARD
d	PENNY (NAIL MEASURE)
D	DEEP, DIFFUSER, DRAIN
DB	DUCT BANK, DECIBEL, DRY BULB
DBA	DEFORMED BAR ANCHOR
DBL	DOUBLE
DC	DIRECT CURRENT
DEG	DEGREE
DEG C	DEGREE CENTIGRADE
DEG F	DEGREE FAHRENHEIT
DEMO	DEMOLITION
DEP	DEPRESSED
DEPT	DEPARTMENT
DET	DETAIL
DI	DROP INLET, DUCTILE IRON, DIGITAL INPUT
DIA	DIAMETER
DIAG	DIAGONAL, DIAGRAM
DIFF	DIFFERENTIAL, DIFFERENCE
DIM	DIMENSION
DISCH	DISCHARGE
DIST	DISTANCE, DISTRIBUTION
DIV	DIVISION
DL	DEAD LOAD
DMJ	DOUBLE MECHANICAL JOINT
DMPF	DAMP PROOFING
DN	DOWN
DO	DISSOLVED OXYGEN, DIGITAL OUTPUT, DITTO
DP	DEPTH
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DS	DOWN SPOUT
DT	DOUBLE TEE, DRIP TRAP ASSEMBLY
DUP	DUPLICATE
DWG	DRAWING
DWL	DOWEL
DWR	DRAWER
E	EAST
EA	EACH, EXHAUST AIR
EC	ELECTRICAL CONTRACTOR
ECC	ECCENTRIC
ED	EQUIPMENT DRAIN
EDB	ELECTRICAL DUCT BANK
EE	EACH END
EF	EACH FACE
EFF	EFFLUENT, EFFICIENCY
EHH	ELECTRICAL HANDHOLE
EIFS	EXTERIOR INSULATION & FINISH SYSTEM
EJ	EXPANSION JOINT
EL	ELBOW, ELEVATION
ELEC	ELECTRICAL
EMBD	EMBEDDED
EMER	EMERGENCY
EMH	ELECTRICAL MANHOLE
ENCL	ENCLOSURE
ENGR	ENGINEER
ENTR	ENTRANCE
EOP	EDGE OF PAVEMENT
EQ	EQUAL EQUIP EQUIPMENT
EQUIV	EQUIVALENT
ES	EACH SIDE, EQUAL SPACE, EMERGENCY SHOWER
ESEW	EMERGENCY SHOWER AND EYE WASH
EST	ESTIMATE
EW	EACH WAY, EMERGENCY EYE/FACE WASH
EWC	ELECTRIC WATER COOLER
EWEF	EACH WAY, EACH FACE
EWTB	EACH WAY, TOP AND BOTTOM
EXC	EXCAVATION
EXH	EXHAUST
EXP	EXPANSION, EXPOSED
EXST	EXISTING
EXT	EXTERIOR, EXTERNAL, EXTENSION
F TO F	FACE TO FACE
F&B	FACE AND BYPASS
FAB	FABRICATE
FB	FLOOR BEAM
FBD	FIBERBOARD
FBG	FIBERGLASS
FBM	BOARD FOOT MEASURE
FBO	FURNISHED BY OWNER
FC	FLUSHING CONNECTION
FCA	FLANGED COUPLING ADAPTER
FD	FLOOR DRAIN
FDC	FLEXIBLE DUCT CONNECTION
FDR	FEEDER
FDTN	FOUNDATION
FE	FLANGED END
FEC	FIRE EXTINGUISHER CABINET
FES	FLARED END SECTION
FEXT	FIRE EXTINGUISHER
FF	FAR FACE, FACTORY FINISH, FLAT FACE
FG	FINISHED GRADE
FH	FIRE HYDRANT
FIG	FIGURE
FIN	FINISH
FJT	FLUSH JOINT
FL	FLOW, FLOW LINE
FLEX	FLEXIBLE
FLG	FLANGE
FLOR	FLUORESCENT
FLR	FLOOR
FLS	FLASHING, FLUSH

FN	FENCE
FO	FINISHED OPENING
FOB	FLAT ON BOTTOM
FOC	FACE OF CONCRETE, FACE OF CURB
FOF	FACE OF FINISH
FOM	FACE OF MASONRY
FOS	FACE OF STUDS
FOT	FLAT ON TOP
FPT	FEMALE PIPE THREAD
FR	FRAME
FRP	FIBERGLASS REINFORCED PLASTIC
FRTM	FIRE RETARDANT TREATED MATERIAL
FS	FLOOR SINK, FAR SIDE
FT	FEET, FOOT
FTG	FOOTING, FITTING
FUR	FURRED, FURRING
FURN	FURNITURE, FURNISH
FUT	FUTURE
FV	FACE VELOCITY
FW	FIELD WELD, FIRE WALL
FWD	FORWARD
FWE	FURNISHED WITH EQUIPMENT
FXTR	FIXTURE
G	GRILLE, GROUND
GA	GAGE (METAL THICKNESS)
GAL	GALLON
GALV	GALVANIZED
GB	GRAB BAR, GRADE BREAK
GC	GROOVED COUPLING
GD	GUARD
GEN	GENERAL
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFMU	GROUND FACE MASONRY UNIT
GG	GUTTER GRADE
GJ	GROOVED JOINT
GL	GLASS
GLB	GLASS BLOCK, GLULAM BEAM
GND	GROUND
GP	GUY POLE
GR	GRADE
GRTG	GRATING
GSB	GYPSUM SHEATHING BOARD
GT	GREASE TRAP
GVL	GRAVEL
GW	GUY WIRE
GWB	GYPSUM WALLBOARD
GYP	GYPSUM HARDBOARD
H	HIGH
HB	HOSE BIBB
HBD	HARDBOARD
HC	HANDICAPPED, HOLLOW CORE, HORIZONTAL CURVE, HORIZONTAL CENTERLINE
HD	HEAD, HOT DIP
HDR	HEADER
HDW	HARDWARE
HEX	HEXAGONAL
HGR	HANGER
HH	HANDHOLE
HID	HIGH-INTENSITY DISCHARGE
HM	HOLLOW METAL
HORIZ	HORIZONTAL
HP	HIGH POINT, HORSEPOWER
HPC	HORIZONTAL POINT OF CURVATURE
HPS	HIGH-PRESSURE SODIUM
HPT	HORIZONTAL POINT OF TANGENCY
HR	HOSE REEL, HOUR
HS	HEADED STUD, HIGH STRENGTH
HSS	HOLLOW STRUCTURAL SHAPE
HT	HEIGHT
HTG	HEATING
HV	HIGH VOLTAGE
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HWD	HARDWOOD
HWL	HIGH WATER LEVEL
HYD	HYDRAULIC
HZ	HERTZ, CYCLES PER SECOND
ID	INSIDE DIAMETER, INTERIOR DIMENSION
IE	INVERT ELEVATION, FOR EXAMPLE
IF	INSIDE FACE
IH	INTAKE HOOD
IMP	IMPACT
IN	INCH
INC	INCLUDE, INCANDESCENT
INF	INFLUENT
INSTR	INSTRUMENTATION
INSUL	INSULATION
INT	INTERIOR, INTERSECTION
INTR	INTERMEDIATE, INTERIOR
INV	INVERT
IPS	IRON PIPE SIZE
IPT	INTERNAL PIPE THREAD
IR	INSIDE RADIUS, IRON ROD
IRR	IRRIGATION
ISO	ISOMETRIC
JB	JUNCTION BOX
JCT	JUNCTION
JF	JOINT FILLER
JST	JOIST
JT	JOINT
K	KIP
KB	KNEE BRACE
KCMIL	THOUSAND CIRCULAR MILS
KD	KNOCK DOWN
KO	KNOCK OUT
KSI	KIPS PER SQUARE INCH
KW	KILOWATT
L	ANGLE, LENGTH, LAVATORY, LINTEL
LAD	LADDER
LAM	LAMINATE
LATL	LATERAL
LB	LAG BOLT, POUND
LCTB	LIQUID CHALK AND TACK BOARD
LDG	LANDING

LDR	LEADER
LE	LIFTING EYE
LF	LINEAR FOOT
LG	LONG
LH	LEFT HAND
LIN	LINEAR
LIQ	LIQUID
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LMLU	LIQUID MARKER LECTURE UNIT
LNG	LONGITUDINAL
LOC	LOCATION
LP	LOW POINT
LPS	LOW-PRESSURE SODIUM
LR	LONG RADIUS
LT	LEFT
LTD	LIMITED
LTG	LIGHTING
LTL	LINTEL
LTNG	LIGHTNING
LV	LOW VOLTAGE
LVL	LAMINATED VENEER LUMBER
LVR	LOUVER
LW	LIGHTWEIGHT
LWC	LIGHTWEIGHT CONCRETE
LWL	LOW WATER LEVEL
MA	MIXED AIR
MACH	MACHINED
MAINT	MAINTENANCE
MAN	MANUAL
MATL	MATERIAL
MAX	MAXIMUM
MB	MACHINE BOLT
MBR	MEMBER
MC	MECHANICAL CONTRACTOR, MECHANICAL COUPLING, MOMENT CONNECTION
MCB	METAL CORNER BEAD
MCJ	MASONRY CONTROL JOINT
MDMJ	MODIFIED DOUBLE MECHANICAL JOINT
MECH	MECHANICAL
MED	MEDIUM
MFR	MANUFACTURER
MH	MANHOLE, METAL HALIDE
MIN	MINIMUM
MIR	MIRROR
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
ML	MASONRY LINTEL
MLO	MAIN LUGS ONLY
MMB	MEMBRANE
MO	MASONRY OPENING
MOD	MODULAR, MODIFY
MON	MONUMENT
MPT	MALE PIPE THREAD
MRGWB	MOISTURE-RESISTANT GYPSUM WALLBOARD
MS	MOP SINK
MSL	MEAN SEA LEVEL
MT	MOUNT
MU	MASONRY UNIT
MULL	MULLION
MV	MEDIUM VOLTAGE
MW	MONITORING WELL
N	NORTH, NEUTRAL
NA	NOT APPLICABLE
NAT	NATURAL, NATIONAL
NC	NORMALLY CLOSED
NEG	NEGATIVE
NF	NEAR FACE, NON-FUSED
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NOM	NOMINAL
NPS	NOMINAL PIPE SIZE
NPT	NATIONAL PIPE THREAD
NS	NEAR SIDE
NTS	NOT TO SCALE
NWL	NORMAL WATER LEVEL
O TO O	OUT TO OUT
OA	OUTSIDE AIR, OVERALL
OC	ON CENTER
OCPD	OVER CURRENT PROTECTION DEVICE
OD	OUTSIDE DIAMETER
OED	OPEN END DUCT
OF	OUTSIDE FACE, OFFICE FURNISHING
OFCI	OWNER FURNISHED CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED OWNER INSTALLED
OG	ORIGINAL GROUND
OH	OVERHEAD
OPNG	OPENING
OPP	OPPOSITE
OPT	OPTIONAL
OR	OUTSIDE RADIUS
ORD	OVERFLOW ROOF DRAIN
ORIG	ORIGINAL
OVFL	OVERFLOW
OVHG	OVERHANG
OZ	OUNCE
P	PAINT
PA	PUBLIC ADDRESS
PAR	PARALLEL, PARAPET
PB	PANIC BAR, PULL BOX
PBD	PARTICLE BOARD
PC	POINT OF CURVE, PIECE, PRECAST
PCC	POINT OF COMPOUND CURVATURE
PCF	POUNDS PER CUBIC FOOT
PCT	PERCENT
PE	PLAIN END
PED	PEDESTAL
PEN	PENETRATION
PERF	PERFORATED
PERM	PERMANENT
PERP	PERPENDICULAR
PF	POWER FACTOR
PFMU	PREFACED MASONRY UNIT
PH	PHASE
PI	POINT OF INTERSECTION

PKG	PACKAGE
PL	PLATE, PROPERTY LINE, PRECAST LINTEL
PLAS	PLASTER
PLAT	PLATFORM
PLBG	PLUMBING
PLF	POUNDS PER LINEAR FOOT
PNEU	PNEUMATIC
POL	POLISH POS POSITIVE, POSITION
PP	POLYPROPYLENE, POWER POLE
PRC	POINT OF REVERSE CURVATURE
PREF	PREFINISHED
PREFAB	PREFABRICATED
PRELIM	PRELIMINARY
PREP	PREPARE
PRES	PRESSURE
PRI	PRIMARY
PROP	PROPERTY, PROPOSED
PROT	PROTECTION
PS	PIPE SUPPORT
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIA	POUNDS PER SQUARE INCH ABSOLUTE
PSIG	POUNDS PER SQUARE INCH GAGE
PST	PRESTRESSED
PT	POINT, POINT OF TANGENCY
PTN	PARTITION
PVC	POLYVINYL CHLORIDE, POINT OF VERTICAL CURVE
PVMT	PAVEMENT
PWD	PLYWOOD
PWJ	PLYWOOD WEB JOIST
PZ	PIEZOMETER
Q	RATE OF FLOW
QT	QUARRY TILE
QTR	QUARTER
QTY	QUANTITY
QUAL	QUALITY
R&R	REMOVE AND REPLACE
R&S	REMOVE AND SALVAGE
R	RADIUS, REGISTER, RISER
RA	RETURN AIR
RB	RESILIENT BASE, ROCK BERM
RCPT	RECEPTACLE
RD	ROOF DRAIN
REC	RECESS
RECD	RECEIVED
RECT	RECTANGULAR
RED	REDUCER
REF	REFERENCE
REINF	REINFORCING
REM	REMOVE
REQD	REQUIRED
RESIL	RESILIENT
RET	RETAINING, RETURN
REV	REVISION, REVERSE
RF	RESILIENT FLOORING
RFG	ROOFING
RFL	REFLECTED, REFLECTOR
RGH	ROUGH
RGS	RIGID GALVANIZED STEEL
RGS-PVC	PVC COATED RGS
RH	RELIEF HOOD, RIGHT HAND, RELATIVE HUMIDITY
RL	REQUIRED LAP
RLFA	RELIEF AIR
RND	ROUND
RNG	RUNNING
RO	ROUGH OPENING
ROW	RIGHT-OF-WAY
RPM	REVOLUTIONS PER MINUTE
RR	RAILROAD
RSP	ROCK SLOPE PROTECTION
RT	RIGHT
RVT	RESILIENT VINYL TILE
RY	READY
S	SOUTH, SINK
SA	SUPPLY AIR
SAMU	SOUND-ABSORBING MASONRY UNIT
SAN	SANITARY
SB	SPLASH BLOCK
SC	SOLID CORE
SCH	SCHEDULE
SCHEM	SCHEMATIC
SCN	SCREEN
SE	STEEL/ALUMINUM EDGE
SEC	SECONDARY, SECONDS
SECT	SECTION
SEP	SEPARATE
SF	SQUARE FOOT, SILT FENCE
SG	SHEET GLASS, SEALANT GROOVE
SH	SHOWER
SHT	SHEET
SHTG	SHEATHING
SIL	SILENCE
SIM	SIMILAR
SJ	SLAB JOINT
SL	SLOPE, STEEL LINTEL
SLTD	SLOTTED
SLV	SLEEVE
SMLS	SEAMLESS
SOG	SLAB ON GRADE
SP	SOUNDPROOF, STANDPIPE
SPA	SPACING
SPEC	SPECIFICATION
SPLY	SUPPLY
SPST	SINGLE POLE SINGLE THROW
SPT	SET POINT
SQ	SQUARE
SR	SHORT RADIUS
SS	SERVICE SINK
SST	STAINLESS STEEL
ST	STREET
STA	STATION
STD	STANDARD
STIF	STIFFENER
STIR	STIRRUP
STL	STEEL
STOR	STORAGE

STR	STRUCTURAL, STRAIGHT
SUB	SUBSTITUTE
SUC	SUCTION
SUSP	SUSPENDED
SY	SQUARE YARD
SYM	SYMBOL
SYMM	SYMMETRICAL
SYN	SYNTHETIC
SYS	SYSTEM
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
T	TILE, TREAD
TA	TOILET ACCESSORY, TEMPERED AIR
TAN	TANGENT
TBM	TEMPORARY BENCHMARK
TCE	TEMPORARY CONSTRUCTION EASEMENT
TEF	TROWELED EPOXY FLOORING
TEMP	TEMPORARY, TEMPERATURE
THD	THREAD
THK	THICK THRESH THRESHOLD
TKBD	TACK BOARD
TOB	TOP OF BOLT, TOP OF BANK, TOP OF BEAM, TOP OF BERM
TOC	TOP OF CURB, TOP OF CONCRETE
TOD	TOP OF DUCT
TOF	TOP OF FOOTING
TOG	TOP OF GRATING
TOL	TOLERANCE, TOP OF LEDGER
TOM	TOP OF MASONRY
TOP	TOP OF PLATE
TOPO	TOPOGRAPHY
TOS	TOP OF SLAB, TOP OF STEEL, TOE OF SLOPE
TOW	TOP OF WALL
TP	TOILET PARTITION, TELEPHONE POLE, TOE PLATE, TRAP
	PRIMER
TPD	TOILET PAPER DISPENSER
TPG	TOPPING, THROUGH PLATE GIRDER
TR	TRANSOM
TRANS	TRANSITION
TRD	TRENCH DRAIN
TYP	TYPICAL
U	URINAL
UG	UNDERGROUND
ULT	ULTIMATE
UNFN	UNFINISHED
UNO	UNLESS NOTED OTHERWISE
UTIL	UTILITY
V	VENT, VELOCITY, VOLT
VA	VOLT AMPERE
VAC	VACUUM
VAR	VARNISH, VARIABLE, VOLT AMPERES REACTIVE
VB	VAPOR BARRIER, VINYL BASE, VALVE BOX
VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE
VCT	VINYL COMPOSITION TILE, VERTICAL CENTERLINE
VEL	VELOCITY
VENT	VENTILATION
VERT	VERTICAL
VERTS	VERTICAL REINFORCING
VG	VERTICAL GRAIN
VIF	VERIFY IN FIELD
VIN	VINYL
VOL	VOLUME
VPC	VERTICAL POINT OF CURVATURE
VPI	VERTICAL POINT OF INTERSECTION
VPT	VERTICAL POINT OF TANGENCY
VS	VERSUS, VAPOR SEAL
VTR	VENT THROUGH ROOF
VWC	VINYL WALL COVERING
W/	WITH
W/O	WITHOUT
W	WATT, WEST, WIDE, WINDOW, WIRE, WIDE FLANGE BEAM
WB	WOOD BASE
WC	WATER CLOSET, WATER COLUMN
WD	WOOD, WIDTH
WF	WIDE FLANGE, WASH FOUNTAIN
WG	WIRE GLASS, WATER GAGE
WH	WALL HYDRANT, WEEP HOLE
WI	WROUGHT IRON
WL	WATER LEVEL
WLD	WELDED
WM	WIRE MESH
WP	WEATHERPROOF
WS	WATERSTOP, WATER SURFACE
WSCT	WAINSCOT
WT	WEIGHT, WATER TIGHT
WTHP	WATERPROOF, WORKING POINT
WWF	WELDED WIRE FABRIC
XP	EXPLOSION-PROOF
XS	EXTRA STRONG
XSECT	CROSS SECTION
XXS	DOUBLE EXTRA STRONG
YH	YARD HYDRANT
YS	YIELD STRENGTH

GENERAL NOTES

1. THESE ABBREVIATIONS APPLY TO THE ENTIRE SET OF CONTRACT DRAWINGS.
2. LISTING OF ABBREVIATIONS DOES NOT IMPLY THAT ALL ABBREVIATIONS ARE USED IN THE CONTRACT DRAWINGS.
3. ABBREVIATIONS SHOWN ON THIS SHEET INCLUDE VARIATIONS OF A WORD. FOR EXAMPLE, "MOD" MAY MEAN MODIFY OR MODIFICATION, "INC" MAY MEAN INCLUDED OR INCLUDING, AND "REINF" MAY MEAN REINFORCE OR REINFORCING.
4. SEE INSTRUMENTATION AND GENERAL LEGEND SHEETS FOR PROJECT-SPECIFIC EQUIPMENT AND PIPING SYSTEM ABBREVIATIONS.

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
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PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE ABBREVIATIONS

0 1" 2"

FILENAME 10386668-G.rvt
SCALE 12" = 1'-0"

SHEET G-002

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-G.rvt
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MATERIALS IN PLAN/SECTION

FILLED REGIONS - MATERIALS
"MATERIAL" FILLED REGIONS ARE DRAFTING HATCH PATTERNS THAT REPRESENTS AN ACTUAL MATERIAL OR PRODUCT.

- MATERIAL - BITUMINOUS PAVING (ASPHALT)
- MATERIAL - CONCRETE - ARCHITECTURE PRECAST WALL PANEL
- MATERIAL - CONCRETE - ARCHITECTURAL PRECAST WALL PANEL
- MATERIAL - CONCRETE - CAST-IN-PLACE
- MATERIAL - CONCRETE - GLASS FIBER REINFORCED
- MATERIAL - CONCRETE - LIGHTWEIGHT
- MATERIAL - CONCRETE - STRUCTURAL
- MATERIAL - EFIS
- MATERIAL - FILL - COURSE - CRUSHED STONE
- MATERIAL - FILL - FINE - GRAVEL
- MATERIAL - FILL - FINE - SAND
- MATERIAL - FILL - MEDIUM - GRAVEL
- MATERIAL - FILTER POINT MAT - PLAN
- MATERIAL - FIREPROOFING - MINERAL WOOL
- MATERIAL - FIREPROOFING - SEALANT
- MATERIAL - FIREPROOFING - SPRAY-APPLIED
- MATERIAL - FLOOR - CARPET - STYLE 1
- MATERIAL - FLOOR - CARPET - STYLE 2
- MATERIAL - FLOOR - TERRAZZO - STYLE 1
- MATERIAL - FLOOR - TERRAZZO - STYLE 2
- MATERIAL - GLAZING
- MATERIAL - GLAZING - SPANDREL
- MATERIAL GRATING - PLAN
- MATERIAL GRATING - SECTION
- MATERIAL - GROUT
- MATERIAL - GYPSUM - PLASTER
- MATERIAL - GYPSUM - WALLBOARD
- MATERIAL - INSULATION - BATTING - SECTION
- MATERIAL - INSULATION - RIGID FOAM
- MATERIAL - MASONRY - BRICK
- MATERIAL - MASONRY - CMU
- MATERIAL - MASONRY - DOLMITE
- MATERIAL - MASONRY - MORTAR
- MATERIAL - MASONRY - STRUCTURAL CLAY TILE
- MATERIAL - METAL - ALUMINUM
- MATERIAL - METAL - CHECKERED PLATE - PLAN
- MATERIAL - METAL - ORNAMENTAL
- MATERIAL - METAL - STEEL
- MATERIAL - PLASTER STUCCO
- MATERIAL - PLASTIC
- MATERIAL - RESILIENT TILE
- MATERIAL - RIPRAP - PLAN AND/OR SECTION
- MATERIAL - SEALANT - ACOUSTICAL
- MATERIAL - SEALANT - FIRE SEALANT
- MATERIAL - SOD - SECTION
- MATERIAL - SOIL - COMPACTED - EARTH
- MATERIAL - SOIL - COMPACTED - FINE
- MATERIAL - SOIL - UNDISTURBED - FINE
- MATERIAL - SOIL - UNDISTURBED - EARTH
- MATERIAL - STONE - CAST
- MATERIAL - STONE - CUT FINISHED
- MATERIAL - SYSTEM - DRAINABLE EXTERIOR INSULATION AND FINISH
- MATERIAL - TERRAZZO - 1
- MATERIAL - TERRAZZO - 2
- MATERIAL - TILE - PORCELAIN
- MATERIAL - WEEP JOINT MORTAR PROTECTION SYSTEM - SECTION
- MATERIAL - WOOD - FINISH - COURSE GRAIN
- MATERIAL - WOOD - FINISH - FINE GRAIN
- MATERIAL - WOOD - FINISH VERTICAL GRAIN
- MATERIAL - WOOD FLOORING
- MATERIAL - WOOD - GLULAM
- MATERIAL - WOOD - MDF
- MATERIAL - WOOD - PARTICLE BOARD
- MATERIAL - WOOD - PLYWOOD
- MATERIAL - WOOD - CONTINUOUS - SECTION
- MATERIAL - WOOD - BLOCKING - SECTION

Filled Regions - Graphics
GRAPHIC FILLED REGIONS ARE DRAFTING HATCH PATTERNS THAT ARE A SIMPLE GRAPHIC PATTERN AND DOES NOT REPRESENT A MATERIAL OR PRODUCT.

- MATERIAL - RESILIENT SHEET
- GRAPHIC - CONTRACT LIMIT - NOT-IN-CONTRACT

Filled Regions - Surface
SURFACE FILLED REGIONS ARE MODELING HATCH PATTERNS THAT REPRESENT A MATERIAL OR PRODUCT AS REPRESENTED ON A VERTICAL OR HORIZONTAL SURFACE.

Ceiling Tiles

- SURFACE - CEILING TILE - 24" x 24"
- SURFACE - CEILING TILE - 24" x 24" - DEMO
- SURFACE - CEILING TILE - 24" x 48"
- SURFACE - CEILING TILE - 24" x 48" - DEMO
- SURFACE - CEILING TILE - 24" x 72"
- SURFACE - CEILING TILE - 24" x 72" - DEMO
- SURFACE - CEILING TILE - 48" x 48"
- SURFACE - CEILING TILE - 48" x 48" - DEMO
- SURFACE - CEILING - ACOUSTICAL TILE - SECTION

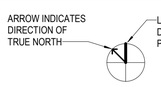
Masonry

- SURFACE - MASONRY - BRICK - MODULAR - RUNNING BOND
- SURFACE - MASONRY - CMU - 8" x 16" - RUNNING BOND
- SURFACE - MASONRY - CMU - 8" x 16" - STACKED BOND

Metals

- SURFACE - ENTRANCE GRID - 65 MM

GENERAL SYMBOLOGY



NORTH ARROW

PLAN TITLE ON SHEET

DETAIL

FOR REFERENCING DETAILS INCLUDED IN DRAWING SET.
1. DETAIL NUMBER
2. SHEET WHERE DETAIL IS LOCATED *

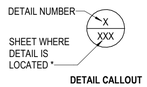
SECTION

1. SECTION NUMBER
2. SHEET WHERE SECTION VIEW IS FIRST CUT *

ELEVATION

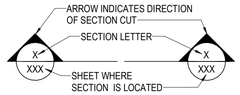
1. ELEVATION IDENTIFICATION NUMBER
2. SHEET WHERE POINT OF VIEW MARKER CAN BE FOUND *

SECTION, DETAIL, ELEVATION TITLE

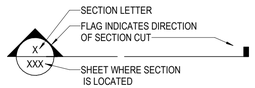


DETAIL CALLOUT

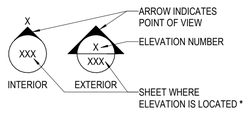
FOR REFERENCING DETAILS INCLUDED IN DRAWING SET.



FULL BUILDING SECTION CUT MARKER



SECTION CUT MARKER



SINGLE ELEVATION OR PHOTO MARKER

MULTIPLE ELEVATION OR PHOTO MARKER

TARGET ELEVATION MARKER

* EXCEPTIONS WHERE THE SHEET NUMBER IS REPLACED BY A DASH (-)

1. FOR COMMON DETAILS, SECTIONS, ELEVATIONS OR DETAILS THAT ARE CUT OR CALLED OUT ON MULTIPLE SHEETS.
2. SECTIONS, ELEVATIONS OR DETAILS THAT ARE LOCATED ON THE SAME SHEET THEY ARE CUT OR CALLED OUT ON.

GENERAL TAGGING

ROOM/SPACE NAME
XX-XX — ROOM OR SPACE

XXX — DOOR

DOOR MARK | STAIR
XXX | XXX
XXXX | XXXX — FIRE DOOR/STAIR

A — NEW COLUMN GRID BUBBLE

A — EXISTING COLUMN GRID BUBBLE

X — WALL TYPE

X — CURTAIN WALL

X — WINDOW TYPE

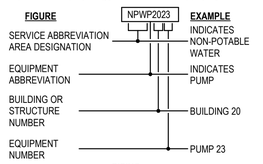
X — ACCESSORY, FURNITURE, AND MISCELLANEOUS EQUIPMENT IDENTIFIER

KEYNOTE NUMBER
X — LOUVER TYPE
— SHEET KEYNOTE

— REVISION DELTA

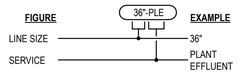
EQUIPMENT IDENTIFICATION

NOTE: THE BELOW EQUIPMENT TAG IS AN EXAMPLE ONLY. MODIFY FIELDS AS REQUIRED PER THE PROJECT STANDARD.

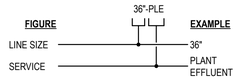


PIPING

NOTE: THE BELOW PIPE TAG IS AN EXAMPLE ONLY. MODIFY FIELDS AS REQUIRED PER THE PROJECT STANDARD.



PIPING (ALTERNATE)



GENERAL LINE STYLES

- 4-HOUR FIRE RATED WALL
- 3-HOUR FIRE RATED WALL
- 2-HOUR FIRE RATED WALL
- 1-HOUR FIRE RATED WALL
- COLUMN GRID LINE
- CENTERLINE
- CONTRACT LIMIT
- ELEVATION LINE
- MATCHLINE
- PROPERTY LINE

SHEET NAMING CONVENTION

AREA DESIGNATION

TO BE EDITED ON AN A PROJECT BASIS. TO BE DETERMINED BY THE PROJECT MANAGER, THEN ADDED TO THE GENERAL LEGEND.

EXAMPLE:
01 BUILDING OR AREA NAME
02 BUILDING OR AREA NAME
03 BUILDING OR AREA NAME

SINGLE DISCIPLINE DESIGNATOR & DISCIPLINE ORDER*

G	GENERAL
X	DEMOLITION/HAZARDOUS MATERIAL
V	SURVEYING/MAPPING
B	GEOTECHNICAL
C	CIVIL
L	LANDSCAPE
S	STRUCTURAL
A	ARCHITECTURAL
I	INTERIORS
Q	EQUIPMENT
F	FIRE PROTECTION
P	PLUMBING
D	PROCESS
M	MECHANICAL
E	ELECTRICAL
W	DISTRIBUTED ENERGY
T	TELECOMMUNICATIONS
R	RESOURCE
U	UNIVERSAL/OTHER DISCIPLINES
Y	INSTRUMENTATION & CONTROLS
Z	CONTRACTOR/SHOP DRAWINGS
O	OPERATIONS

DOUBLE LETTER DESIGNATOR*

SEE LINKED NCS DOCUMENT:

\\intranet.hdr\hdr\Eng\ECGCADStandards\BIM\Autodesk\Common \Documentation\NCS_Discipline_Designators.pdf

SHEET TYPE DESIGNATOR

0	GENERAL (SYMBOLS, LEGENDS)
1	PLANS
2	ELEVATIONS
3	SECTIONS
4	LARGE SCALE VIEWS
5	DETAILS
6	SCHEDULES AND DIAGRAMS
7	OTHER VIEWS

*NCS ALLOWS THE COMBINED USE OF BOTH SINGLE AND DOUBLE LETTER DISCIPLINE DESIGNATORS WITHIN A PROJECT.

EXAMPLE 1 (WITH BUILDING SERIES, SINGLE LETTER DESIGNATOR)

GRAVITY THICKENER STRUCTURAL FOUNDATION PLAN, DRAWING 01

0	2						BUILDING OR AREA 02
BUILDING OR AREA DESIGNATION							
		S	-				STRUCTURAL
DISCIPLINE DESIGNATOR							
				1			PLAN
SHEET TYPE DESIGNATOR							
					0	1	SHEET 01
SHEET NUMBER							
0	2	S	-	1	0	1	EXAMPLE

EXAMPLE 2 (WITH BUILDING SERIES, DOUBLE LETTER DESIGNATOR)

GRAVITY THICKENER STRUCTURAL FOUNDATION PLAN, DRAWING 01

0	2						BUILDING OR AREA 02
BUILDING OR AREA DESIGNATION							
		S	B				STRUCTURAL
DISCIPLINE DESIGNATOR							
				1			PLAN
SHEET TYPE DESIGNATOR							
					0	1	SHEET 01
SHEET NUMBER							
0	2	S	B	1	0	1	EXAMPLE

EXAMPLE 3 (NO BUILDING SERIES, DOUBLE LETTER DESIGNATOR)

GRAVITY THICKENER STRUCTURAL FOUNDATION PLAN, DRAWING 01

							BUILDING OR AREA (LEFT BLANK)
BUILDING OR AREA DESIGNATION (LEFT BLANK)							
		S	B				STRUCTURAL
DISCIPLINE DESIGNATOR							
				1			PLAN
SHEET TYPE DESIGNATOR							
					0	1	SHEET 01
SHEET NUMBER							
		S	B	1	0	1	EXAMPLE

FIRE & LIFE SAFETY

GENERAL NOTES

1. THIS IS A STANDARD SHEET SHOWING COMMON SYMBOLOGY. ALL SYMBOLS ARE NOT NECESSARILY USED ON THIS PROJECT.
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ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
GENERAL LEGEND

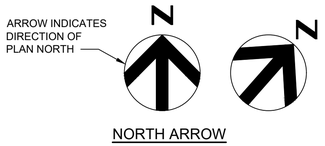
0 1" 2"

FILENAME 10386668-G.rvt
SCALE 12" = 1'-0"

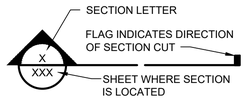
SHEET G-003

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-G.rvt
6/13/2024 1:44:21 PM

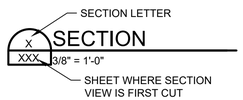
GENERAL SYMBOLOGY



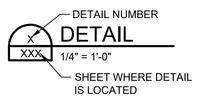
NORTH ARROW



SECTION CUT MARKER



SECTION TITLE



DETAIL TITLE

CIVIL MAPPING SYMBOLOGY

	SURVEY CONTROL POINT
MW-X	GROUNDWATER MONITORING WELL
GEW-X	GAS EXTRACTION WELL
DEW-X	DUAL EXTRACTION WELL
LEW	LEACHATE EXTRACTION WELL
MMP	METHANE MONITORING PROBE
PZ-X	GROUNDWATER PIEZOMETER
SP-X	GROUNDWATER CONTROL TRENCH STAND PIPE
	ISOLATION VALVE
MH	UTILITY MANHOLE
	LEACHATE COLLECTION PIPE CLEANOUT
Lx	LEACHATE LIFT STATION
	OVERHEAD POWER POLE
	GUY WIRE
	LFG CONDENSATE HIGH POINT
	SURFACE DRAINAGE FLOW DIRECTION

MATERIALS IN PLAN / SECTION

	STRUCTURAL FILL (SECTION)
	PLACED SOIL (SECTION)
	NATIVE SOIL (SECTION)
	DAILY / INTERMEDIATE COVER (SECTION)
	WASTE (SECTION)
	RECOMPACTED CLAY (SECTION)
	VEGETATIVE SOIL LAYER (SECTION)
	PROTECTIVE SOIL COVER (SECTION)
	DRAINAGE LAYER (SECTION)
	RIP-RAP / REVETMENT STONE (PLAN/SECTION)
	SAND (SECTION)
	COARSE AGGREGATE (SECTION)
	LETDOWN (PLAN)
	HAUL ROAD (PLAN)
	RECOMPACTED CLAY LINER (SECTION)
	CAREFULLY COMPACTED BACKFILL (SECTION)

UTILITY/CIVIL LINE SYMBOLOGY

PROP	PROPERTY BOUNDARY
WASTE	LIMITS OF WASTE
	INTERNAL CELL/PHASE BOUNDARY
	FENCE - BARB WIRE
	FENCE - CHAIN LINK
	FENCE - WOOD
	EXISTING MINOR CONTOUR
25	EXISTING MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
25	PROPOSED MAJOR CONTOUR
	VEGETATION/BRUSH LINE
	TREES / SHRUBBERY
LEA	LEACHATE PIPE - SOLID WALL
LEA	LEACHATE PIPE - PERFORATED
FM	LEACHATE FORCEMAIN
GWT	GROUNDWATER PIPE / TRENCH
	LARGE PIPELINE
SD	STORMWATER PIPING
	STORMWATER CULVERT
> >	DRAINAGE TERRACE
>> >>	DRAINAGE DITCH / SWALE
G	GAS HEADER PIPE
G G G	GAS COLLECTOR PIPE
UGE	UNDERGROUND POWER
OHE	OVERHEAD POWER LINE
FO	FIBER OPTIC SERVICE
W	WATER MAIN
WTL	WETLANDS DELINEATION
SS	SANITARY SEWER

SYMBOLOGY NOTES

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ABBREVIATIONS

&	AND
@	AT
ADS	ADVANCED DRAINAGE SYSTEMS, INC.
AISI	AMERICAN IRON & STEEL INSTITUTE
APPROX	APPROXIMATE
℄	
℄ or CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CWTS	CONSTRUCTED WETLANDS TREATMENT SYSTEM
CPP	CORRUGATED PLASTIC PIPE
Ø or DIA	DIAMETER
E	EAST or ELECTRICAL
EL or ELEV	ELEVATION
EXST	EXISTING
EXT	EXTENSION
FES	FLARED END SECTION
FL	FLOWLINE
FT	FOOT or FEET
GALV	GALVANIZED
GAL	GALLON
GEW	GAS EXTRACTION WELL
GW	GROUNDWATER
HDPE	HIGH DENSITY POLYETHYLENE
HORIZ	HORIZONTAL
ID	INNER DIAMETER
IE	INVERT ELEVATION
IN	INCH or INCHES
L	ANGLE
LB or LBS	POUND/S
LLDPE	LINEAR LOW DENSITY POLYETHYLENE
MAX	MAXIMUM
MFG'S	MANUFACTURER'S
MH	MANHOLE
MIN	MINIMUM
MPE	METRO PARK EAST
MWA	METRO WASTE AUTHORITY
N	NORTH
NA	NOT APPLICABLE
NO.	NUMBER
OD	OUTER DIAMETER
OZ	OUNCE
PC	POINT OF CURVATURE
PI	POINT OF INTERSECTION
PL	PLATE
POB	POINT OF BEGINNING
POE	POINT OF END
PP	POLYPROPYLENE
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
R or RAD	RADIUS
REQ'D	REQUIRED
ROW	RIGHT OF WAY
SEC	SECTION
S	SOUTH
SPA	SPACING
SS	STAINLESS STEEL
STA	STATION
STL	STEEL
TEMP	TEMPORARY
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W	WEST
W/	WITH

GENERAL NOTES

1. SITE TOPOGRAPHY AERIAL SURVEY PROVIDED BY AEROVIEW SERVICES, DATED JUNE 27, 2023. SITE LINEWORK IS A COMPILATION OF HISTORIC SITE INFORMATION PROVIDED BY METRO WASTE AUTHORITY AND RECORD DRAWING INFORMATION.
2. SITE COORDINATES ARE BASED UPON IOWA STATE PLANE NORTH, NAVD88.THIS SYSTEM SHALL BE USED FOR ALL PROJECT SURVEYING AND RECORD DOCUMENT PRODUCTION.
3. DO NOT OBSTRUCT LANDFILL SITE ACCESS ROADS, MAIN ACCESS ROADS, OR PROJECT ACCESS/EGRESS ROUTE. COORDINATE ALL ROADWAY WORK TO ENSURE CONTINUOUS SITE ACCESS. SEE SPECIFICATIONS.
4. OBTAIN ALL REQUIRED BORROW FROM WITHIN APPROVED SOIL BORROW AREA, UNLESS OTHERWISE APPROVED BY OWNER.
5. LOCATE AND PROTECT SITE UTILITIES AND STRUCTURES (INCLUDING MONITORING WELLS, PIEZOMETERS, GROUNDWATER CONTROL STANDPIPES, RISERS, TRENCHES, BURIED UTILITIES, LEACHATE MANHOLES, ELECTRICAL, ETC.). ANY STRUCTURES REMOVED OR DAMAGED SHALL BE REPAIRED AND REPLACED AT CONTRACTOR'S EXPENSE.
6. CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL WORK FROM EROSION AND SEDIMENT CAUSED BY THE ADJACENT EXISTING LANDFILL. SEDIMENT AND WASTE ACCUMULATION WITHIN THE LIMITS OF CONSTRUCTION SHALL BE REMOVED AT CONTRACTOR'S EXPENSE. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE EROSION CONTROL MEASURES MEET MINIMUM FEDERAL, STATE, AND LOCAL REGULATIONS.
7. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING EXISTING DRAINAGE CHANNELS, CULVERTS, SEDIMENT BASINS, AND TRAPS AFFECTED BY THE WORK. CONTRACTOR SHALL REMOVE ACCUMULATED SEDIMENT AND DEBRIS FROM THE CONTROL MEASURES AND ANY AFFECTED STRUCTURES FOLLOWING COMPLETION OF THE WORK AND PLACE AT LOCATION APPROVED BY OWNER.
8. WHERE DESIGNATED ACCESS ROADS TO SPECIFIC CONSTRUCTION AREAS ARE NOT SHOWN, COORDINATE PLANNED ACCESS ROUTES WITH OWNER AND ENGINEER AT THE PRE-CONSTRUCTION CONFERENCE.
9. IN ALL CASES CONTRACTOR SHALL TAKE CARE TO PREVENT DAMAGE TO ESTABLISHED VEGETATION DUE TO CONTRACTOR VEHICLE TRAFFIC. CONTRACTOR SHALL REPAIR ALL VEGETATION AND SOIL DAMAGE (I.E. RUTTING) CAUSED BY CONSTRUCTION ACTIVITIES IN MANNER SUITABLE TO OWNER PRIOR TO COMPLETION OF PROJECT WORK.

PROJECT SERIES DESCRIPTION

a. SCALE HOUSE

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

CIVIL LEGEND AND GENERAL NOTES

0 1" 2"

FILENAME G-004.dwg
SCALE

SHEET G-004

PIPING SYSTEMS

- COLD WATER, POTABLE (CW)
- HOT WATER, POTABLE (HW)
- HOT WATER RECIRCULATING, POTABLE (HWC)
- NPW — NON POTABLE COLD WATER
- 140 — HOT WATER - TEMPERATURE, POTABLE
- TW — TEPID WATER, POTABLE
- TWR — TEPID WATER RETURN, POTABLE
- SAN — SANITARY SEWER BELOW GRADE
- SAN — SANITARY SEWER ABOVE GRADE
- V — SANITARY VENT
- AW — ACID WASTE
- AV — ACID VENT
- CW — COMBINATION WASTE AND VENT
- PD — PRESSURE DRAINAGE
- SD — STORM DRAIN ABOVE GRADE
- SD — STORM DRAIN BELOW GRADE
- OD — STORM DRAIN OVERFLOW
- NG — NATURAL GAS
- LP — LIQUEFIED PROPANE
- CA — COMPRESSED AIR
- HWS — HEATING HOT WATER SUPPLY
- HWR — HEATING HOT WATER RETURN
- GHWS — GLYCOL HEATING HOT WATER SUPPLY
- GHWR — GLYCOL HEATING HOT WATER RETURN
- CHWS — CHILLED WATER SUPPLY
- CHWR — CHILLED WATER RETURN
- GCWS — GLYCOL CHILLED WATER SUPPLY
- GCWR — GLYCOL CHILLED WATER RETURN
- CWS — CONDENSER WATER SUPPLY
- CWR — CONDENSER WATER RETURN
- RL — REFRIGERANT LIQUID
- RS — REFRIGERANT SUCTION
- CD — CONDENSATE DRAIN
- CPD — CONDENSATE PUMP DISCHARGE
- STM -15 — STEAM SUPPLY - PSI
- BBD — BOILER BLOW DOWN
- BF — BOILER FEED
- SV — STEAM VENT
- MU — MAKE-UP WATER

PIPING SYMBOLOGY

- PIPE ANCHOR
- PIPE GUIDE
- EXPANSION JOINT
- PT — PRESSURE/ TEMPERATURE PORT
- THERMOMETER
- THERMOWELL
- PRESSURE GAUGE
- TEMPERATURE GAUGE
- FLEXIBLE PIPING CONNECTION
- WYE STRAINER
- MANUAL AIR VENT
- A — AUTOMATIC AIR VENT
- M — METER (WATER, GAS, OTHER)
- FCO — FLOOR CLEANOUT
- CO — CLEANOUT
- WCO — WALL CLEANOUT
- GCO — DOUBLE GRADE CLEANOUT
- WATER HAMMER ARRESTOR
- E — EARTHQUAKE VALVE
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER, FLAT ON BOTTOM
- ECCENTRIC REDUCER, FLAT ON TOP
- ELBOW, 90° TURN DOWN
- ELBOW, 90° TURN UP
- TEE, OUTLET UP
- TEE, OUTLET DOWN
- TEE, OUTLET UP W/ 90° TURN
- TEE, OUTLET DOWN W/ 90° TURN
- PIPE BREAK
- PIPE CAP
- BLIND FLANGE
- UNION
- FLOW ARROW
- SHUTOFF VALVE (NORMALLY OPEN)
- SHUTOFF VALVE (NORMALLY CLOSED)
- DRAIN VALVE
- CHECK VALVE
- VACUUM BREAKER
- VB — AUTOMATIC FLOW CONTROL VALVE
- CALIBRATED MANUAL BALANCING VALVE
- OR — PRESSURE-RELIEF VALVE
- PRESSURE-REDUCING VALVE (PRV)
- AUTOMATIC CONTROL VALVE, 2-WAY
- AUTOMATIC CONTROL VALVE, 3-WAY
- BFP — BACKFLOW PREVENTER
- XX-1 — PLUMBING FIXTURE

HVAC SYMBOLOGY

- 24x18 — SUPPLY AIR OR OUTSIDE AIR DUCT UP (SECTION CUT, FIRST DIMENSION DUCT WIDTH)
- SUPPLY AIR OR OUTSIDE AIR DUCT DOWN (NO SECTION CUT)
- RETURN AIR DUCT UP (SECTION CUT)
- RETURN AIR DUCT DOWN (NO SECTION CUT)
- EXHAUST AIR DUCT UP (NO SECTION CUT)
- EXHAUST AIR DUCT DOWN (NO SECTION CUT)
- ROUND ELBOW UP
- ROUND ELBOW DOWN
- TRANSITION - RECTANGULAR TO ROUND DUCT
- STANDARD BRANCH
- ELBOW - W/TURNING VANE (RECTANGULAR)
- ELBOW - (RECTANGULAR), SMOOTH RADIUS
- 18x24 — RECTANGULAR DUCT OR OPENING SIZE FIRST NUMBER INDICATES SIZE OF SIDE SHOWN
- 18 ⌀ — ROUND DUCT SIZE
- R OR D — RECTANGULAR DUCT INCLINE - RISE OR DROP IN RESPECT TO THE AIR FLOW
- R OR D — ROUND DUCT INCLINE - RISE OR DROP IN RESPECT TO THE AIR FLOW
- 18x24 — HIDDEN DUCT
- T ⌀ -10" / B ⌀ -0" / 18x10 — DUCT/PIPE ELEVATION TAG ABOVE FINISH FLOOR
- VOLUME DAMPER
- M — MOTOR OPERATED DAMPER
- FIRE DAMPER
- S — SMOKE DAMPER
- S — SMOKE AND FIRE DAMPER
- FLEXIBLE CONNECTION
- FLEXIBLE DUCT - TWO LINE
- FLEXIBLE DUCT - ONE LINE
- ACOUSTICAL LINING - DUCT DIMENSIONS FOR NET FREE AREA
- UC — UNDERCUT DOOR
- NEW TO EXISTING CONNECTION
- REMOVE EXISTING UP TO THIS POINT
- HVAC EMERGENCY SHUTDOWN SWITCH

- TAG-SIZE CFM — SUPPLY AIR REGISTER
- TAG-SIZE CFM — EXHAUST AIR OR RETURN AIR GRILLE
- TAG CFM — EXHAUST AIR OR RETURN AIR GRILLE
- TAG CFM — SUPPLY AIR ASSEMBLY SQUARE DIFFUSER
- TAG CFM — SUPPLY AIR ASSEMBLY ROUND DIFFUSER

TEMPERATURE CONTROL DIAGRAM SYMBOLOGY

MISCELLANEOUS DEVICE IDENTIFIER

CO	SPACE CARBON MONOXIDE SENSOR
CO2	SPACE CARBON DIOXIDE SENSOR
H	SPACE HUMIDITY SENSOR
NO2	SPACE NITROGEN DIOXIDE SENSOR
S	SPACE TEMPERATURE SENSOR
T	THERMOSTAT

CONTROL DEVICE IDENTIFIER

AFS	AIRFLOW MEASURING STATION
AM	AIRFLOW MEASURING SENSOR
CO	CARBON MONOXIDE SENSOR
CO2	CARBON DIOXIDE SENSOR
F	FLOW SWITCH
FRZ	FREEZE STAT
H	HUMIDITY SENSOR
HS	HIGH STATIC SWITCH
LS	LOW STATIC SWITCH
NO2	NITROGEN DIOXIDE SENSOR
P	PRESSURE SENSOR
S	SPACE TEMPERATURE SENSOR
SD	SMOKE DETECTOR
T	TEMPERATURE SENSOR
TS	TEMPERATURE SWITCH
ΔP	DIFFERENTIAL PRESSURE SENSOR

CONTROL INPUT/OUTPUT IDENTIFIER

AI	ANALOG INPUT
AO	ANALOG OUTPUT
DI	DIGITAL INPUT
DO	DIGITAL OUTPUT

COIL IDENTIFIERS

CC	CHILLED WATER COOLING COIL
DG	DIRECT FIRED GAS BURNER
DX	DIRECT EXPANSION COOLING COIL
EH	ELECTRIC HEATING COIL
ER	DIRECT EVAPORATIVE COIL
FC	FACE AND BYPASS COOLING COIL
FH	FACE AND BYPASS HEATING COIL
HC	HEATING HOT WATER HEATING COIL
IG	INDIRECT FIRED GAS BURNER
ST	STEAM HEATING COIL

CONTROL ABBREVIATIONS

BTU	BTU METER
COMM	COMMUNICATION
CT	CURRENT TRANSMITTER
EC	ELECTRONICALLY COMMUTATED
EF	EXHAUST FAN
FM	FLOW METER
M	MOTOR ACTUATOR
MA	MIXED AIR
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
OA	OUTDOOR AIR
RA	RETURN AIR
RF	RETURN FAN
RL	RELIEF FAN
SA	SUPPLY AIR
SF	SUPPLY FAN
TCC	TEMPERATURE CONTROL CONTRACTOR
VFD	VARIABLE FREQUENCY DRIVE

- S — DUCT MOUNTED SMOKE DETECTOR
- T — TEMPERATURE AVERAGING SENSOR
- M — MOTOR OPERATED DAMPER
- M — MOTOR OPERATED SINGLE BLADE DAMPER
- BACKDRAFT DAMPER
- HUMIDIFIER
- AFS — AIRFLOW MEASURING STATION
- INTAKE/ EXHAUST LOUVER
- FILTER
- FRZ — FREEZE STAT
- SEE CONTROL ABBREVIATIONS (TYP)
- M XX — FAN
- EC XX — FAN WITH EC MOTOR
- PUMP
- EC — PUMP WITH EC MOTOR

ABBREVIATIONS

AD	ACCESS DOOR
AFR	ABOVE FINISHED ROOF
AHU	AIR HANDLING UNIT
APD	AIR PRESSURE DROP
ARF	ABOVE RAISED FLOOR
AV	AIR VALVE
BAS	BUILDING AUTOMATION SYSTEM
BDD	BACK DRAFT DAMPER
BHP	BRAKE HORSE POWER
BOE	BOTTOM OF EQUIPMENT
BTUH	BRITISH THERMAL UNITS PER HOUR
CAV	CONSTANT AIR VOLUME
CFH	CUBIC FEET PER HOUR
CFM	CUBIC FEET PER MINUTE
COP	COEFFICIENT OF PERFORMANCE
COR	CONTRACTING OFFICER'S REPRESENTATIVE
CRAC	COMPUTER ROOM AIR CONDITIONER
CU	CONDENSING UNIT
DB	DRY BULB
DDC	DIRECT DIGITAL CONTROL
DH	DEHUMIDIFIER
DX	DIRECT EXPANSION
EAT	ENTERING AIR TEMPERATURE
EDH	ELECTRIC DUCT HEATER
EER	ENERGY EFFICIENCY RATIO
EMCS	ENERGY MANAGEMENT CONTROL SYSTEM
ERU	ENERGY RECOVERY UNIT
ESP	EXTERNAL STATIC PRESSURE
ESS	EMERGENCY SHUTOFF SWITCH
EWT	ENTERING WATER TEMPERATURE
F	FUTURE
FA	FREE AREA
FCP	FAN CONTROL PANEL
FCU	FAN COIL UNIT
FDBK	FEEDBACK
FLA	FULL LOAD AMPS
FLT	FILTER
FPB	FAN POWERED BOX
FPM	FEET PER MINUTE
GC	GENERAL CONTRACTOR
GE	GRAVITY EXHAUST
GI	GRAVITY INTAKE
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
I/O	INPUT/OUTPUT
I/P	CURRENT TO PNEUMATIC
IAQ	INDOOR AIR QUALITY
IPLV	INTEGRATED PART LOAD VALUE
LAT	LEAVING AIR TEMPERATURE
LVR	LOUVER
LWT	LEAVING WATER TEMPERATURE
MAU	MAKE-UP AIR UNIT
MBH	THOUSAND BTUH
MCC	MOTOR CONTROL CENTER
NC	NOISE CRITERIA
NO	NUMBER
NRC	NOISE REDUCTION COEFFICIENT
OS&Y	OUTSIDE SCREW AND YOKE
PD	PRESSURE DROP
PPH	POUNDS PER HOUR
RH	RELATIVE HUMIDITY
RTU	ROOFTOP UNIT
S	SIGNAL PORT
SCFM	STANDARD CUBIC FEET PER MINUTE
SEER	SEASONAL ENERGY EFFICIENCY RATIO
SP	STATIC PRESSURE
TC	TECHNOLOGY CONTRACTOR
TCP	TEMPERATURE CONTROL PANEL
TD	TEMPERATURE DIFFERENTIAL
TES	THERMAL ENERGY STORAGE
TSP	TOTAL STATIC PRESSURE
UH	UNIT HEATER
V&C	VALVE AND CAP
VAV	VARIABLE AIR VOLUME
VRF	VARIABLE REFRIGERANT FLOW
VTR	VENT THROUGH ROOF
WB	WET BULB
WC	WATER COLUMN
WPD	WATER PRESSURE DROP

GENERAL NOTES

GENERAL MECHANICAL DEMOLITION NOTES

1. THE CONTRACTOR SHALL COMPLETELY REMOVE ALL PIPING, DUCTWORK, COILS, EQUIPMENT, TERMINAL UNITS, ASSOCIATED CONTROLS, WIRING, AND OTHER ITEMS SHOWN BOLD AND/OR BOLD DASHED LINES UNLESS SPECIFICALLY NOTED OTHERWISE. THE ITEMS INDICATED ON THE DRAWINGS TO BE REMOVED ARE ONLY TO INDICATE IN GENERAL THE AMOUNT OF DEMOLITION WORK INVOLVED. A SITE INVESTIGATION BY THE CONTRACTOR MUST BE PERFORMED TO AID IN DETERMINING THE COMPLETE EXTENT OF WORK INVOLVED.
2. PIPING AND DUCTWORK EMBEDDED IN FLOORS, WALLS, AND CEILINGS MAY REMAIN IF SUCH MATERIALS DO NOT INTERFERE WITH NEW INSTALLATIONS. REMOVE MATERIALS ABOVE ACCESSIBLE CEILINGS. REMAINING PIPING SHALL BE DRAINED AND CAPPED WITHOUT CREATING DEAD LEGS IN THE SYSTEM. REMAINING DUCTWORK SHALL BE CAPPED.
3. LOCATE, IDENTIFY, AND PROTECT MECHANICAL SERVICES PASSING THROUGH DEMOLITION AREA AND SERVING OTHER AREAS OUTSIDE THE DEMOLITION LIMITS. MAINTAIN SERVICES TO AREAS OUTSIDE DEMOLITION LIMITS. WHEN SERVICES MUST BE INTERRUPTED, NOTIFY OWNER AND INSTALL TEMPORARY SERVICES FOR AFFECTED AREAS.
4. EXISTING EQUIPMENT BEING REMOVED AND CONSIDERED SALVAGEABLE BY THE OWNER SHALL BE TURNED OVER TO THE OWNER.
5. CONTRACTORS SHALL COORDINATE AND SCHEDULE ALL NECESSARY UTILITY SHUT-OFFS WITH OWNER PRIOR TO PROCEEDING WITH SUCH WORK.
6. COORDINATE SAW-CUTTING OF THE FLOOR OR WALL WITH OTHER TRADES.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PATCHING, PAINTING, REPAIRING OR REPLACEMENT OF ALL WALLS, FLOORS, CEILINGS, OR OTHER BUILDING ELEMENTS THAT ARE DISTURBED AS PART OF THE DEMOLITION OR INSTALLATION OF MECHANICAL WORK. SUCH WORK SHALL MATCH THE EXISTING CONSTRUCTION, FINISH, AND RATING. FIRE SEAL WALL OPENINGS AS REQUIRED.
8. REPLACE/REPAIR DAMAGED PIPING AND/OR DUCTWORK INSULATION TO MATCH EXISTING.
9. CONTRACTOR SHALL PROVIDE WORK IN PHASES AS REQUIRED BY THE CONTRACT DOCUMENTS WHILE MINIMIZING POTENTIAL WORK DELAYS AND UTILITY SHUT-DOWNS. COORDINATE ALL WORK WITH PROJECT PHASING PLAN AND WORK SHOWN ON DEMOLITION AND NEW PLANS. ALL EXISTING AREAS OF THE BUILDING NOT A PART OF A CURRENT PHASE OF WORK SHALL REMAIN OPERATIONAL WHILE WORK IN EACH INDIVIDUAL PHASE IS COMPLETED.

GENERAL MECHANICAL NOTES

1. THESE NOTES ARE NOT ALL INCLUSIVE. REFER TO DRAWINGS AND SPECIFICATION FOR ADDITIONAL REQUIREMENTS.
2. THIS IS A STANDARD MECHANICAL (HVAC AND PLUMBING) SYMBOLOGY AND ABBREVIATIONS SHEET. LISTING OF SYMBOLS AND ABBREVIATIONS DOES NOT IMPLY ALL SYMBOLS AND ABBREVIATIONS HAVE BEEN USED ON THIS PROJECT.
3. VALVE SYMBOLS SHOWN HERE ARE APPLICABLE ONLY TO MECHANICAL SHEETS.
4. PROVIDE ALL MATERIALS, LABOR, AND EQUIPMENT FOR COMPLETE AND OPERABLE SYSTEMS AS INDICATED ON THE DRAWINGS AS SPECIFIED, OR AS REQUIRED BY CODE.
5. MECHANICAL INSTALLATION SHALL COMPLY WITH THE ADA/ABA ACCESSIBILITY GUIDELINES.
6. DETAILS APPLY TO THE ENTIRE PROJECT AND ARE ONLY REFERENCED TO PROVIDE CLARITY IF THERE ARE MULTIPLE DETAILS THAT COULD APPLY TO A PARTICULAR PROJECT CONDITION.
7. COORDINATE LOCATION OF ALL MECHANICAL EQUIPMENT, DUCTWORK, AND PIPING WITH OTHER TRADES BEFORE PROCEEDING WITH WORK. DO NOT INSTALL MECHANICAL EQUIPMENT, DUCTWORK, OR PIPING ABOVE ELECTRICAL EQUIPMENT WHERE PROHIBITED BY ELECTRICAL CODES (SWITCHBOARDS, PANELS, ETC.)
8. LIGHT LINE WEIGHT INDICATES EXISTING PIPING, DUCTWORK, AND/OR EQUIPMENT TO REMAIN. BOLD LINE WEIGHT INDICATES NEW WORK TO BE INSTALLED AS WORK OF THIS CONTRACT.
9. COORDINATE INSTALLATION OF OUTSIDE AIR INTAKE WITH INSTALLATION OF PLUMBING VENTS, FLUES AND EXHAUST/RELIEF OUTLETS TO MAINTAIN 10' SEPARATION.
10. ALL WORK IN FINISHED SPACES SHALL BE LOCATED ABOVE CEILINGS, IN CHASES OR OTHER CONCEALED ACCESSIBLE LOCATIONS UNLESS NOTED OTHERWISE. LOCATE AND ARRANGE VALVES, DRAIN FITTINGS, ETC. TO BE ACCESSIBLE THROUGH LAY-IN CEILINGS, ACCESS PANELS OR ACCESS DOORS. PROVIDE AN ACCESS PANEL OR DOOR FOR ALL NON-ACCESSIBLE INSTALLATIONS. COORDINATE LOCATION OF ACCESS PANELS OR DOORS WITH THE ARCHITECT/ENGINEER AND OTHER TRADES.
11. ALL MATERIALS LOCATED IN PLENUM SHALL BE RATED FOR PLENUM INSTALLATION.
12. ALL DUCTWORK, PIPING, AND EQUIPMENT SUPPORTED FROM STRUCTURAL STEEL SHALL BE COORDINATED WITH ALL TRADES. ALL ATTACHMENTS TO STEEL BAR JOISTS, TRUSSES, OR JOIST GIRDERS SHALL BE AT PANEL POINTS OR AS SHOWN ON THE MECHANICAL OR STRUCTURAL DRAWINGS. WELDING TO STRUCTURAL MEMBERS SHALL NOT BE PERMITTED.
13. ALL MISCELLANEOUS METALS AND MATERIALS REQUIRED TO ENSURE PROPER INSTALLATION AND AS SHOWN IN DETAILS FOR PIPING, DUCTWORK, AND EQUIPMENT (UNLESS OTHERWISE NOTED) SHALL BE PROVIDED BY THE INSTALLING CONTRACTOR.
14. PROVIDE DIELECTRIC UNIONS AT ALL CONNECTIONS OF DISSIMILAR METALS (SUCH AS COPPER TO GALVANIZED STEEL).
15. PROVIDE ISOLATION VALVES AT EACH PIECE OF EQUIPMENT. ALSO PROVIDE ISOLATION VALVES ON EACH BRANCH AND/OR RISER SERVING MULTIPLE PIECES OF EQUIPMENT OR FIXTURES AND ELSEWHERE AS INDICATED. INSTALL VALVES AS CLOSE TO MAIN AS POSSIBLE.

GENERAL HVAC NOTES

1. DUCTWORK DIMENSIONS: FIRST NUMBER INDICATES SIDE OF DUCTWORK SHOWN. ALL DIMENSIONS ARE IN INCHES AND ARE INSIDE CLEAR DIMENSIONS.
2. VOLUME DAMPERS ABOVE PLASTER OR GYPBOARD CEILINGS SHALL HAVE EXTENSION RODS AND CHROME-PLATED ESCUTCHEON PLATES.
3. COORDINATE ALL GRILLE, REGISTER AND DIFFUSER LOCATIONS WITH REFLECTED CEILING PLAN, LIGHTING, AND ALL OTHER CEILING MOUNTED DEVICES.
4. PROVIDE FLEXIBLE CONNECTIONS IN ALL DUCTWORK AND PIPING SYSTEMS CONNECTED TO FANS, PUMPS AND OTHER EQUIPMENT WHICH REQUIRE VIBRATION ISOLATION.
5. PROVIDE ACCESSIBLE VOLUME DAMPERS OR OTHER MEANS OF AIRFLOW ADJUSTMENT AT ALL DUCT RUN-OUTS TO DIFFUSERS AND GRILLES.
6. PROVIDE DUCT ACCESS DOORS AT OUTSIDE AIR INTAKE PLENUMS.
7. ALL DUCT RUN-OUTS TO DIFFUSERS AND GRILLES SHALL BE THE SAME AS THE DIFFUSER OR GRILLE NECK SIZE UNLESS NOTED OTHERWISE.
8. ALL PIPING RUNOUTS SHALL BE 3/4" UNLESS NOTED OTHERWISE.

GENERAL PLUMBING NOTES

1. SANITARY SEWER PIPING SMALLER THAN 3" SHALL BE SLOPED AT 1/4" PER FOOT, 3" AND LARGER SHALL BE SLOPED AT 1/8" PER FOOT.
2. WALL HYDRANTS SHALL BE INSTALLED BETWEEN 18" MIN AND 24" MAX ABOVE FINISH GRADE. COORDINATE ELEVATIONS OF FINISH FLOOR OR FINISH EXTERIOR GRADE. PROVIDE ACCESSIBLE INSIDE SHUTOFF VALVE FOR EACH WALL HYDRANT.
3. INSTALL WALL CLEANOUTS (WCO) ON ALL SANITARY AND STORM RISERS AT 30" ABOVE FINISH FLOOR UNLESS NOTED OTHERWISE. COORDINATE EXACT HEIGHT WITH OTHER TRADES TO ENSURE ACCESSIBILITY.
4. ROUTE ALL STORM PIPING AS HIGH AS POSSIBLE AND SLOPE AT 1/8" PER FOOT UNLESS NOTED OTHERWISE. OVERFLOW DOWN SPOUT NOZZLES SHALL BE INSTALLED AT 12" ABOVE FINISH EXTERIOR GRADE UNLESS NOTED OTHERWISE.
5. PROVIDE BACKFLOW PREVENTERS IN ACCORDANCE WITH THE LOCAL CODES. PROVIDE AIR GAP FITTINGS FOR ALL RPZ BACKFLOW PREVENTERS AND ROUTE DISCHARGE PIPING TO NEAREST FLOOR DRAIN OR FLOOR SINK OR AS SHOWN ON DRAWINGS.
6. PROVIDE GAS REGULATORS, REGULATOR VENT PIPING, SHUTOFF VALVES, DIRT LEGS, AND UNIONS ON ALL GAS FIRED EQUIPMENT. REGULATE GAS PRESSURE AS REQUIRED FOR EACH SPECIFIC PIECE OF GAS FIRED EQUIPMENT.

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
MECHANICAL LEGEND

0 1" 2"

FILENAME	10386668-G.rvt
SCALE	NONE
SHEET	G-005

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-G.rvt
6/13/2024 11:37:19 AM

ONE-LINE, POWER, AND LIGHTING SYMBOLOGY

20A 3P Y
X 2000AF 1800AT 3P Y
MCP 3P

LOW VOLTAGE CIRCUIT BREAKER (CB). RATING AND NO. OF POLES AS SHOWN. WHEN SPECIFIC TYPE, OTHER THAN MCCB, IS REQUIRED. X INDICATES TYPE
Y INDICATES TRIP UNIT TYPE

TYPES
MCCB - MOLDED CASE
ICCB - INSULATED CASE
LVP - LOW VOLTAGE POWER
MCP - MOTOR CIRCUIT PROTECTOR (RATING PER CONNECTED LOAD)

TRIP UNIT
L - LONG TIME PICKUP
S - SHORT TIME PICKUP
I - INSTANTANEOUS PICKUP
G - GROUND FAULT PICKUP
A - ARC ENERGY REDUCTION MODE

X — PROTECTION RELAY. X - INDICATES IEEE FUNCTION NUMBER

X — INTERLOCK: X - INDICATES TYPE

TYPES
E - ELECTRICAL
M - MECHANICAL
K - KEY

GFP — GROUND FAULT PROTECTION

52 — MEDIUM VOLTAGE CIRCUIT BREAKER

FUSE, RATING, AND NUMBER OF FUSES AS NOTED

FUSED CUTOUT, CURRENT RATING, FUSE RATING, AND QUANTITY AS NOTED

FUSIBLE SWITCH, CURRENT RATING, FUSE RATING, AND QUANTITY AS NOTED (3 POLE UON)

NON-FUSED SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED (3 POLE UON)

DISCONNECT OR DRAWOUT CONNECTION

A C B — MAGNETIC MOTOR STARTER

A C B — SEPARATELY MOUNTED COMBINATION MAGNETIC MOTOR STARTER AND DISCONNECT

D C — MOTOR/LOAD CONTROLLER

D C — SEPARATELY MOUNTED MOTOR/LOAD CONTROLLER WITH SHORT CIRCUIT PROTECTION AND DISCONNECT

MOTOR STARTER AND CONTROLLER SUBSCRIPTS
A - MAGNETIC STARTER NEMA SIZE
B - STARTER TYPE
NONE - FULL VOLTAGE NON-REVERSING (FVNR)
FVR - FULL VOLTAGE REVERSING
2S - TWO SPEED
RVAT - REDUCED VOLTAGE AUTO TRANSFORMER
C - CONTROL DIAGRAM NUMBER
D - CONTROLLER TYPE
VFD - VARIABLE FREQUENCY DRIVE
SS - SOLID STATE
CONT - CONTACTOR

J — SEPARATELY MOUNTED COMBINATION MOTOR STARTER OR CONTROLLER; SEE ELECTRICAL ONE-LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION

J — SEPARATELY MOUNTED MOTOR STARTER OR CONTROLLER; SEE ELECTRICAL ONE-LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION

X J — NON-FUSED SAFETY SWITCH, 30A, 3P, X INDICATES AMP RATING GREATER THAN 30A

X J Y — FUSED SAFETY SWITCH, 30A, 3P,
X INDICATES AMP RATING GREATER THAN 30A
Y INDICATES FUSE SIZE
MR - EQUIPMENT MANUFACTURER RECOMMENDED FUSE SIZE

CB J — SEPARATELY MOUNTED CIRCUIT BREAKER; SEE ELECTRICAL ONE-LINE DIAGRAM OR SCHEDULE FOR DESCRIPTION

7 1/2 — MOTOR WITH DESIGN HORSEPOWER (WHEN INDICATED)

HP — GENERATOR

ATS — TRANSFER SWITCH, CURRENT RATING, AND NUMBER OF POLES AS NOTED
ATS - AUTOMATIC
MTS - MANUAL

TRANSFORMER
3-PHASE, 3-WIRE DELTA CONNECTION
3-PHASE, 4-WIRE GROUNDED WYE CONNECTION

NAME 208/120V 3 PH , 4W — SWITCHBOARD OR PANELBOARD; NAME, VOLTAGE, PHASE, NUMBER OF WIRES WHEN INDICATED

100 KVA — NON-MOTOR LOAD WITH DESIGN KVA, KW, OR AMP

VOLTAGE TRANSFORMER (VT, PT, OR CPT)

CURRENT TRANSFORMER (CT)

WH — UTILITY WATT-HOUR METER PER UTILITY REQUIREMENTS

DMP — DIGITAL METERING PACKAGE

GROUND

LIGHTNING ARRESTER

SPD — LOW VOLTAGE SURGE PROTECTIVE DEVICE

SS — SELECTOR SWITCH

PB — PUSHBUTTON

IC — INSTRUMENTATION / CONTROL DEVICE

SV — SOLENOID VALVE

CONTROL PANEL INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT

CONTROL PANEL WITH DISCONNECT SWITCH INTEGRAL OR PROVIDED WITH ASSOCIATED EQUIPMENT

J OR J — JUNCTION OR PULL BOX

PANELBOARD (250V TO 600V)

PANELBOARD (LESS THAN 250V)

X — ELECTRICAL EQUIPMENT ENCLOSURE ESTIMATED SIZE AS INDICATED. WHEN USED X INDICATES EQUIPMENT TYPE.

EQUIPMENT TYPES
ATS - AUTOMATIC TRANSFER SWITCH
CP - CONTROL PANEL
INV - LIGHTING INVERTER
MTS - MANUAL TRANSFER SWITCH
MCC - MOTOR CONTROL CENTER
UPS - UNINTERRUPTIBLE POWER SUPPLY
VFD - VARIABLE FREQUENCY DRIVE
SB - SWITCHBOARD
SG - SWITCHGEAR
T - TRANSFORMER

PLUG IN RECEPTACLE STRIP, QUANTITY AND SPACING OF RECEPTACLES AS NOTED OR SPECIFIED

X Y — SPECIAL-PURPOSE RECEPTACLE AS DEFINED ON PLANS

X Y — TWO RECEPTACLES IN 2-GANG BOX UNDER COMMON COVER PLATE

X Y — DUPLEX RECEPTACLE

X Y — SIMPLEX RECEPTACLE

X Y — RECESSED FLOOR MOUNTED BOX, QUANTITY AND TYPE OF RECEPTACLES AS INDICATED

RECEPTACLE SUBSCRIPTS
X - INDICATES TYPE
G - GROUND FAULT CIRCUIT INTERRUPTER
TR - TAMPER RESISTANT
USB - USB CHARGING STATION
SPD - SURGE PROTECTIVE DEVICE
Y - INDICATES CIRCUIT NUMBER FROM PANELBOARD

CONDUIT TURNING UP

CONDUIT TURNING DOWN

(#X) — HOMERUN TO SOURCE (E.G. PANELBOARD, MCC) NUMBER IN PARENTHESES REPRESENTS CONDUCTOR SIZE OTHER THAN #12
SINGLE PHASE: 2#12, 1#12G IN 3/4"C
THREE PHASE: 3#12, 1#12G IN 3/4"C
UNLESS OTHERWISE NOTED, CONDUCTOR SIZE IS FOR ENTIRE CIRCUIT, SOURCE TO LAST DEVICE. ALSO, SEE ONE-LINE DIAGRAM FOR CIRCUIT REQUIREMENTS

CONDUIT CONNECTION TO EQUIPMENT

CIRCUIT RUN BETWEEN DEVICES EXPOSED IN NON-ARCHITECTURALLY FINISHED AREAS; CONCEALED IN ARCHITECTURALLY FINISHED AREAS. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.

CONDUIT RUN BETWEEN DEVICES CONCEALED IN NON-ARCHITECTURALLY FINISHED AREAS OR UNDER FLOOR SLAB. CONDUIT AND CONDUCTOR SIZES SHALL BE THE SAME AS THE HOMERUN FOR THE CIRCUIT.

CIRCUIT CONTINUATION

CONDUIT STUBBED OUT AND CAPPED

CORD AND PLUG CONNECTION

XXX XXX — CONDUIT TAG OR CIRCUIT NUMBER - WIRE AND CONDUIT SIZE AS SPECIFIED IN CIRCUIT SCHEDULE ON THE SHEETS

GROUND CABLE

GROUND ROD

Z X Y — CEILING/PENDANT/BOLLARD MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y — CEILING/PENDANT/BOLLARD MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED, EMERGENCY (INTERNAL OR EXTERNAL POWER SOURCE AS INDICATED)

Z X Y — WALL MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y — WALL MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED, EMERGENCY (INTERNAL OR EXTERNAL POWER SOURCE AS INDICATED)

Z X Y — WALL MOUNTED FLOOD LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y — POLE/STANCHION MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y — POLE/STANCHION MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED, EMERGENCY (INTERNAL OR EXTERNAL POWER SOURCE AS INDICATED)

Z X Y — POLE/STANCHION MOUNTED FLOOR LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y — CEILING/PENDANT MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y — WALL MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED

Z X Y X Y — CEILING/PENDANT MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED, ALL OR PARTIAL EMERGENCY (INTERNAL OR EXTERNAL POWER SOURCE AS INDICATED)

Z X Y — WALL MOUNTED LUMINAIRE, LAMP TYPE AS SPECIFIED, ALL OR PARTIAL EMERGENCY (INTERNAL OR EXTERNAL POWER SOURCE AS INDICATED)

X Y — EMERGENCY LIGHT, NUMBER OF ATTACHED HEADS AS SHOWN

X Y — EMERGENCY LIGHT, REMOTE MOUNTED HEAD

X H X Y — DOUBLE-FACED CEILING OR WALL MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS

X Y H X Y — SINGLE-FACED CEILING OR WALL MOUNTED EXIT LIGHT; DIRECTIONAL ARROWS (IF REQUIRED) AS INDICATED ON PLANS

LIGHTING FIXTURE SUBSCRIPTS
X - INDICATES LUMINAIRE TYPE PER LUMINAIRE SCHEDULE
Y - INDICATES CIRCUIT NUMBER FROM PANELBOARD
Z - INDICATES CONTROLLING SWITCH (IF REQUIRED)
NL - NIGHT LIGHT UNSWITCHED

X — ROOM/AREA LIGHTING CONTROL DESIGNATION, SEE LIGHTING CONTROL STRATEGY SCHEDULE FOR REQUIREMENTS

2 a — LOW VOLTAGE DIGITAL WALL SWITCH, NUMBER INDICATES QUANTITY OF PUSH BUTTONS PER SINGLE GANG PLATE, LETTER INDICATES CONTROL ZONE WHEN SHOWN

$ Y X — WALL SWITCH

SUBSCRIPTS
X - INDICATES TYPE
NONE - SINGLE POLE
2 - DOUBLE POLE
3 - THREE-WAY
4 - FOUR-WAY
K - KEY SWITCH
P - PILOT LIGHT
L - LIGHTED HANDLE
DM - DIMMING
MC - MOMENTARY CONTACT
T - TIMER

$ Y X — Y - INDICATES CONTROLLING SWITCH (IF REQUIRED)

MANUAL MOTOR STARTER

SUBSCRIPTS
X - INDICATES TYPE
HP - HORSEPOWER RATED
TE - HORSEPOWER RATED WITH THERMAL ELEMENT
Y - INDICATES SWITCH TYPE
NONE - TOGGLE SWITCH TYPE
R - ROTARY SWITCH TYPE

PC — PHOTOCELL

TC — TIME CLOCK

$ OSX — LIGHTING CONTROL OCCUPANCY SENSOR, WALL MOUNTED, X INDICATES SPECIFIC TYPE AS SPECIFIED

OSX — LIGHTING CONTROL OCCUPANCY SENSOR, CEILING MOUNTED, X INDICATES SPECIFIC TYPE AS SPECIFIED

COMMUNICATION SYMBOLOGY

(2) — WALL MOUNTED DATA OUTLET, NUMBER INDICATES QUANTITY OF JACKS IN OUTLET BOX "0" INDICATES CONDUIT AND DEVICE BOX ROUGH-IN ONLY

(2) — ABOVE CEILING DATA OUTLET, NUMBER INDICATES QUANTITY OF JACKS IN OUTLET BOX "0" INDICATES CONDUIT AND DEVICE BOX ROUGH-IN ONLY

(2) — RECESSED FLOOR MOUNTED DATA OUTLET, NUMBER INDICATES QUANTITY OF JACKS IN OUTLET BOX "0" INDICATES CONDUIT AND DEVICE BOX ROUGH-IN ONLY

AUDIO/VISUAL SYMBOLOGY

TV — TELEVISION OUTLET

S — CEILING MOUNT SPEAKER

S X — WALL MOUNT SPEAKER
SPEAKER SUBSCRIPTS
X - INDICATES HEIGHT

H — HORN TYPE TRANSDUCER

VC — VOLUME CONTROL

PAHE — HEAD END EQUIPMENT

M — FLOOR MOUNTED MICROPHONE JACK

M — WALL MOUNTED MICROPHONE JACK

SECURITY SYMBOLOGY

DOOR POSITION SWITCH

COMBINATION ELECTRIC DOOR STRIKE AND POSITION SWITCH

R P — PROXIMITY CARD READER

R K — PROXIMITY CARD READER WITH KEYPAD

M — DUAL TECHNOLOGY MOTION DETECTOR

REQUEST TO EXIT MOTION DETECTOR

REQUEST TO EXIT PUSH BUTTON

G — GLASS BREAK DETECTOR

PTZ — CCTV CAMERA
PAN/TILT/ZOOM WHEN INDICATED

SEC — SECURITY EQUIPMENT CABINET

R — REMOTE KEYPAD/CONTROL STATION

EMERGENCY ALARM SYMBOLOGY

E — ALARM BELL

E — ALARM HORN

E — ALARM FLASHING LIGHT

E — ALARM BELL AND FLASHING LIGHT COMBINATION UNIT

E — ALARM HORN AND FLASHING LIGHT COMBINATION UNIT

E — PUSHBUTTON OR PULLSTATION

SITE SYMBOLOGY

EXTERIOR PAD MOUNTED TRANSFORMER

POLE - MOUNTED TRANSFORMER

X Y — ELECTRICAL HANDHOLE OR MANHOLE
X - INDICATES SEQUENCE NUMBER
Y- MHX OR HHX

X Y — POLE/STANCHION MOUNTED FLOOD LUMINAIRE, LAMP TYPE AS SPECIFIED

X Y — POLE MOUNTED AREA OR ROADWAY LUMINAIRE, LAMP TYPE AS SPECIFIED

X Y — HIGH MAST LIGHTING, NUMBER OF LUMINAIRES AS SPECIFIED

LIGHTING FIXTURE SUBSCRIPTS
X - INDICATES LUMINAIRE TYPE PER LUMINAIRE SCHEDULE
Y - INDICATES CIRCUIT NUMBER FROM PANELBOARD

POWER POLE

DOWNGUY

UNDERGROUND (UNO) ELECTRICAL AND COMMUNICATION SYSTEMS PATHWAY

OHE — OVERHEAD ELECTRICAL AND COMMUNICATION SYSTEMS PATHWAY

CONTROL SYMBOLOGY

ELECTRICAL CONNECTION

or or — NO ELECTRICAL CONNECTION

SV or — SOLENOID VALVE

X Y — CONTROL/RELAY COIL:
X-INDICATES TYPE
Y-INDICATES LOOP NUMBER, WHEN USED
TYPE
CR - CONTROL RELAY
PC - PHOTOCELL
DP - DEFINITE PURPOSE
M - MOTOR STARTER
TC - TIME CLOCK
LC - LIGHTING CONTACTOR
TR - TIMING RELAY

NORMALLY OPEN CONTACT (N.O.)

NORMALLY CLOSED CONTACT (N.C.)

MICROPROCESSOR (PLC, RTU, ETC.) OUTPUT

MICROPROCESSOR (PLC, RTU, ETC.) INPUT

DENOTES FIELD DEVICE

TERMINAL CONNECTION

CAPACITOR

DIODE

FIELD WIRING EXTERNAL TO CONTROL PANEL

NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS ENERGIZED

NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS ENERGIZED

NORMALLY OPEN TIME DELAY RELAY CONTACT WITH TIME DELAY ON OPENING AFTER COIL IS DE-ENERGIZED

NORMALLY CLOSED TIME DELAY RELAY CONTACT WITH TIME DELAY ON CLOSING AFTER COIL IS DE-ENERGIZED

NORMALLY OPEN TEMPERATURE SWITCH; CLOSE ON RISING TEMPERATURE

NORMALLY CLOSED TEMPERATURE SWITCH; OPEN ON RISING TEMPERATURE

NORMALLY OPEN FLOW SWITCH; CLOSE ON INCREASING FLOW

NORMALLY CLOSED FLOW SWITCH; OPEN ON INCREASING FLOW

NORMALLY OPEN LEVEL SWITCH, CLOSE ON RISING LEVEL

NORMALLY CLOSED LEVEL SWITCH, OPEN ON RISING LEVEL

NORMALLY OPEN PRESSURE SWITCH, CLOSE ON INCREASING PRESSURE

NORMALLY CLOSED PRESSURE SWITCH, OPEN ON INCREASING PRESSURE

CONTROL SYMBOLOGY

NORMALLY OPEN LIMIT SWITCH, CLOSE ON REACHING LIMIT

NORMALLY CLOSED LIMIT SWITCH, OPEN ON REACHING LIMIT

HAND OFF AUTO XOO OOX — 3 POSITION SELECTOR SWITCH, MAINTAINED CONTACTS; UNLESS OTHERWISE NOTED, 2-POSITION SIMILAR

NORMALLY OPEN PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED

NORMALLY CLOSED PUSHBUTTON, MOMENTARY CONTACT UNLESS OTHERWISE NOTED

X — INDICATING LIGHT
X INDICATES LENS COLOR

X — PUSH TO TEST INDICATING LIGHT
X INDICATES LENS COLOR
LENS COLORS
R - RED Y - YELLOW
G - GREEN W - WHITE
B - BLUE A - AMBER

THERMAL OVERLOAD ELEMENT

OL (X) — THERMAL OVERLOAD RELAY CONTACT. WHEN SHOWN X INDICATES QUANTITY.

CPT — CONTROL POWER TRANSFORMER (CPT)

RTM — RUN TIME METER

GENERAL NOTES

1. THIS IS A STANDARD ELECTRICAL SYMBOLOGY SHEET. NOT ALL SYMBOLS MAY BE USED ON THIS PROJECT.
2. SCREENING OR SHADING OF WORK IS USED TO INDICATE EXISTING COMPONENTS OR TO DE-EMPHASIZE PROPOSED IMPROVEMENTS TO HIGHLIGHT SELECTED TRADE WORK. REFER TO CONTEXT OF EACH SHEET FOR USAGE.
3. SEE P&ID LEGEND SHEET FOR PROJECT SPECIFIC EQUIPMENT SYMBOLS, EQUIPMENT ABBREVIATIONS, AND PIPING SYSTEM ABBREVIATIONS.

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
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STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

ELECTRICAL LEGEND

0 1" 2"

FILENAME 10386668-G.rvt
SCALE NONE
SHEET G-006

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-G.rvt
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CODE REVIEW ANALYSIS

1.0 INTRODUCTION

THE FOLLOWING CODE REVIEW NARRATIVE IS PROVIDED TO SERVE AS A BASIS OF UNDERSTANDING FOR THE METRO WASTE AUTHORITY SCALEHOUSE AT 2499 337TH ST, PERRY, IA 50220. THE SCOPE IS THE CONSTRUCTION OF A NEW SCALEHOUSE AND SCALES AT THE METRO WASTE AUTHORITY - METRO PARK WEST. THE FOLLOWING ANALYSIS REVIEWS THE APPLICABLE BUILDING AND LIFE SAFETY CODES.
THE BUILDING CODE/ZONING OFFICIAL FOR THIS PROJECT IS BOONE COUNTY IOWA.

1.1 DESIGN CODES

STATE OF IOWA ADOPTED CODES WITH AMENDMENTS	
BUILDING CODE	2015 INTERNATIONAL BUILDING CODE
FIRE CODE	2015 INTERNATIONAL FIRE CODE
ELECTRICAL CODE	2017 NATIONAL ELECTRICAL CODE
MECHANICAL CODE	2021 INTERNATIONAL MECHANICAL CODE
PLUMBING CODE	2018 UNIFORM PLUMBING CODE
ENERGY CODE	2012 INTERNATIONAL ENERGY CODE
ACCESSIBILITY	2010 ADA STANDARDS FOR ACCESSIBLE DESIGN

CODE DATA TABLE

2.0 - METRO WASTE AUTHORITY

2.1 DESCRIPTION

THE FOLLOWING CODE REVIEW NARRATIVE IS PROVIDED TO SERVE AS A BASIS OF UNDERSTANDING FOR THE METRO WASTE AUTHORITY SCALEHOUSE AT 2499 337TH ST, PERRY, IA 50220. THE SCOPE IS THE CONSTRUCTION OF A NEW SCALEHOUSE AND SCALES AT THE METRO WASTE AUTHORITY - METRO PARK WEST. THE FOLLOWING ANALYSIS REVIEWS THE APPLICABLE BUILDING AND LIFE SAFETY CODES.

2.2 GENERAL BUILDING DATA SUMMARY

OCCUPANCY CLASSIFICATION(S)	GROUP B - BUSINESS
BUILDING AREA	1059 SF
FIRE AREA	1059 SF
HEIGHT	19'-5"
TYPE OF CONSTRUCTION	TYPE V-B
FIRE SEPARATION DISTANCE	FIRE SEPARATION DISTANCE IS > 30 FT
FIRE PROTECTION SYSTEMS	FIRE EXTINGUISHERS, FIRE HYDRANTS
OCCUPANT LOAD (TOTAL)	N/A

2.3 USE & OCCUPANCY CLASSIFICATION:		IBC	IFC
OCCUPANCY GROUP(S):	GROUP B - BUSINESS	§306	-
ACCESS. OCCUPANCY (<10%)	N/A	-	-
CLASSIFICATION OF HAZARDS	N/A	TABLE 307.1(1) & 307.1(2)	TABLES 5003.1.1(1) & 5003.1.1(2)

2.4 SPECIAL REQUIREMENTS:		IBC	IFC
AREAS WITH HAZARDOUS MATERIALS	N/A	§414	-
EMERGENCY EYE WASH / EMERGENCY SHOWER (EEW/ES) STATIONS	N/A	[29 CODE OF FEDERAL REGULATIONS, OSHA 1910.151]	-

2.5 BUILDING HEIGHTS & AREAS:		IBC	IFC
ACTUAL HEIGHT & AREA	AREA -1059 SF HEIGHT -19'-5"	-	-
ALLOWABLE AREA/STORY	9,000 SF/2 STORIES	TABLE 506.2	-
ALLOWABLE HEIGHT	40 FT	TABLES 504.3 & 504.4	-
MEZZANINE AREA (%)	N/A	§505.2	-
EQUIPMENT PLATFORMS (%)	N/A	§505.3	-
FRONTAGE INCREASE	N/A	§506.3	-
UNLIMITED AREA BUILDINGS	N/A	§507	-
MIXED-USE & OCCUPANCY	N/A	§508	-
INCIDENTAL USES	N/A	§509	-
SPECIAL PROVISIONS	N/A	§510	-

2.6 TYPES OF CONSTRUCTION:		IBC	IFC
CONSTRUCTION TYPE	V-B	§602.2	-
GENERAL BUILDING FIRE-RESISTANCE RATINGS	0-HR	TABLE 601	-
FIRE SEPARATION DISTANCE	FIRE SEPARATION DISTANCE IS > 30 FT	TABLE 602	-

2.7 FIRE & SMOKE PROTECTION:		IBC	IFC
SHAFT ENCLOSURES FIRE-RESISTANCE RATINGS	N/A	§707.3.1 & §713.4	-
VERTICAL EXIT ENCLOSURE FIRE-RESISTANCE RATINGS	N/A	§707.3.3 & §1023.1	-
OCCUPANCY SEPARATION	N/A	§707.3.2 §1019.3 §1023	-
OPENING PROTECTIVES	N/A	§716	-
DUCT AND AIR TRANSFER OPENINGS	N/A	§717	-
EXTERIOR WALL OPENINGS	NO LIMIT	TABLE 705.8	-
CORRIDORS	N/A	§1020	-

2.8 INTERIOR FINISHES:		IBC	IFC
CEILING & WALL (ROOMS AND ENCL. SPACES)	CLASS C	TABLE 803.13	-
CEILING & WALL (EXIT ENCLOSURES)	N/A		
CEILING & WALL (CORRIDORS)	N/A		
FLOOR	CLASS II	§804.4	-

2.9 FIRE PROTECTION SYSTEMS:		IBC	IFC
AUTOMATIC SPRINKLER SYSTEM	N/A	§903.2.4	§903.2.4
PORTABLE FIRE EXTINGUISHERS	REQUIRED; PROVIDED THROUGHOUT	§906.1	§906.1
FIRE ALARM AND DETECTION	N/A	§907.2.4	§907.2.4
FIRE-FLOW REQUIREMENT	1,500 GPM (@20 PSI) FOR 2 HOURS	-	TABLE B105.1(2), TABLE B105.2
MINIMUM NUMBER OF HYDRANTS	MINIMUM OF 1 REQUIRED AND SPACED AT 500'	-	TABLE C102.1

2.10 MEANS OF EGRESS:		IBC	IFC
CUMMULATIVE OCCUPANT LOAD	6 OCCUPANTS	§1004	-
STORAGE/MECHANICAL/EQUIPMENT ROOMS	31 SF @ 1:300 SF (GROSS) = 1 PERSON		-
EGRESS CAPACITY PER O.L.	0.3 (STAIRS) & 0.2 (OTHER)	§1005.3	-
EXIT ACCESS - COMMON PATH OF TRAVEL	GROUP B: 100 FT	TABLE 1006.2.1	-
EXIT ACCESS - TRAVEL DISTANCE	GROUP B: 200 FT	TABLE 1017.2	-
MIN. EXIT DOORS	1; SEE LIFE SAFETY PLANS FOR EXITING	§1006	-
ACCESSIBLE MEANS OF EGRESS	PROVIDED, SEE LIFE SAFETY PLANS	§1009	-
EXIT DISCHARGE; ACCESS TO PUBLIC WAY	PUBLIC WAY	§1028.5	-

2.11 ACCESSIBILITY:		IBC	IFC
EQUIPMENT SPACES	EQUIPMENT SPACES ARE EXEMPT	§1103.2.9	-

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STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
CODE ANALYSIS

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE NONE

SHEET
G-102

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MEANS OF EGRESS CAPACITY			
	PROVIDED EGRESS CAPACITY - LEVEL COMPONENTS & RAMPS		
EXIT ID	EGRESS CAPACITY FACTOR	CLEAR WIDTH	OCCUPANT LOAD CAPACITY
101A	0.2	2' - 8"	160
108A	0.2	2' - 8"	160

MEANS OF EGRESS SCHEDULE		
	EGRESS DISTANCE	
EGRESS PATH ID	PROVIDED	MAXIMUM PERMITTED
TD-1	41' - 0"	200' - 0"

LIFE SAFETY PLAN LEGEND

NOTE: ALL SYMBOLS MAY NOT BE USED.

EXITS

X'-X" CLEAR DOOR WIDTH [FEET - INCHES]

XXX EXIT EGRESS CAPACITY [NO.OF PEOPLE]

EGRESS PATH

TRAVEL DISTANCE — — TD — →

COMMON PATH — — CP — →

DEAD END — — DE — →

EGRESS DISCHARGE

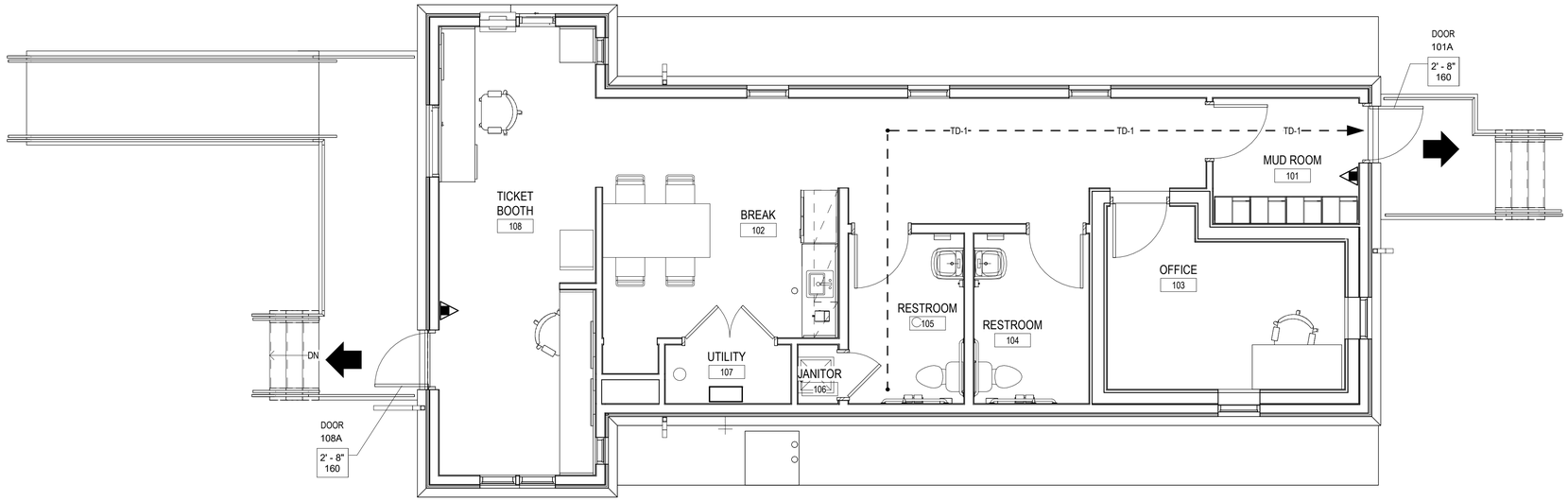
EXIT DISCHARGE

FIRE EXTINGUISHERS

FIRE EXTINGUISHER

EXIT SIGNS

1. REFER TO ELECTRICAL LIGHTING DRAWINGS FOR EXIT SIGNS AND EMERGENCY LIGHTING.



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Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

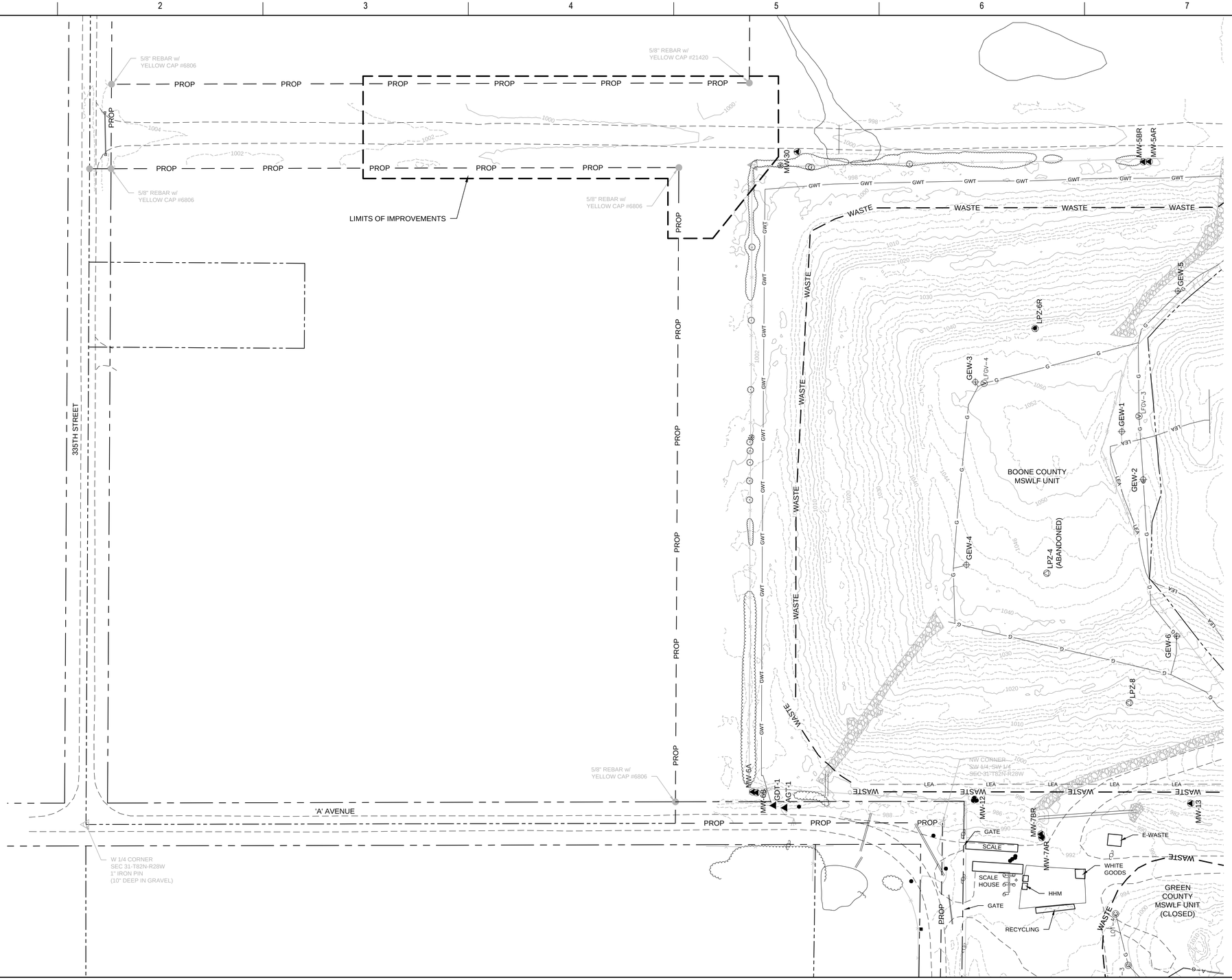
SCALE HOUSE
LIFE SAFETY

0 1" 2"

FILENAME 10386668-SAF.rvt

SCALE 1/4" = 1'-0"

SHEET G-103



N

NOTES:

1. EXISTING TOPOGRAPHY PROVIDED BY AEROVIEW SERVICES DATED JUNE 27, 2023.
2. UTILITY INFORMATION BASED ON HISTORIC SURVEY AND AS-BUILTS. SUBJECT TO CHANGE BASED ON SITE NEEDS.
3. EXACT PLACEMENT OF IMPROVEMENTS MAY VARY AT THE TIME OF CONSTRUCTION BASED ON FIELD CONDITIONS.

ISSUE	DATE	DESCRIPTION
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Metro Waste Authority

METRO PARK WEST SCALE HOUSE DESIGN

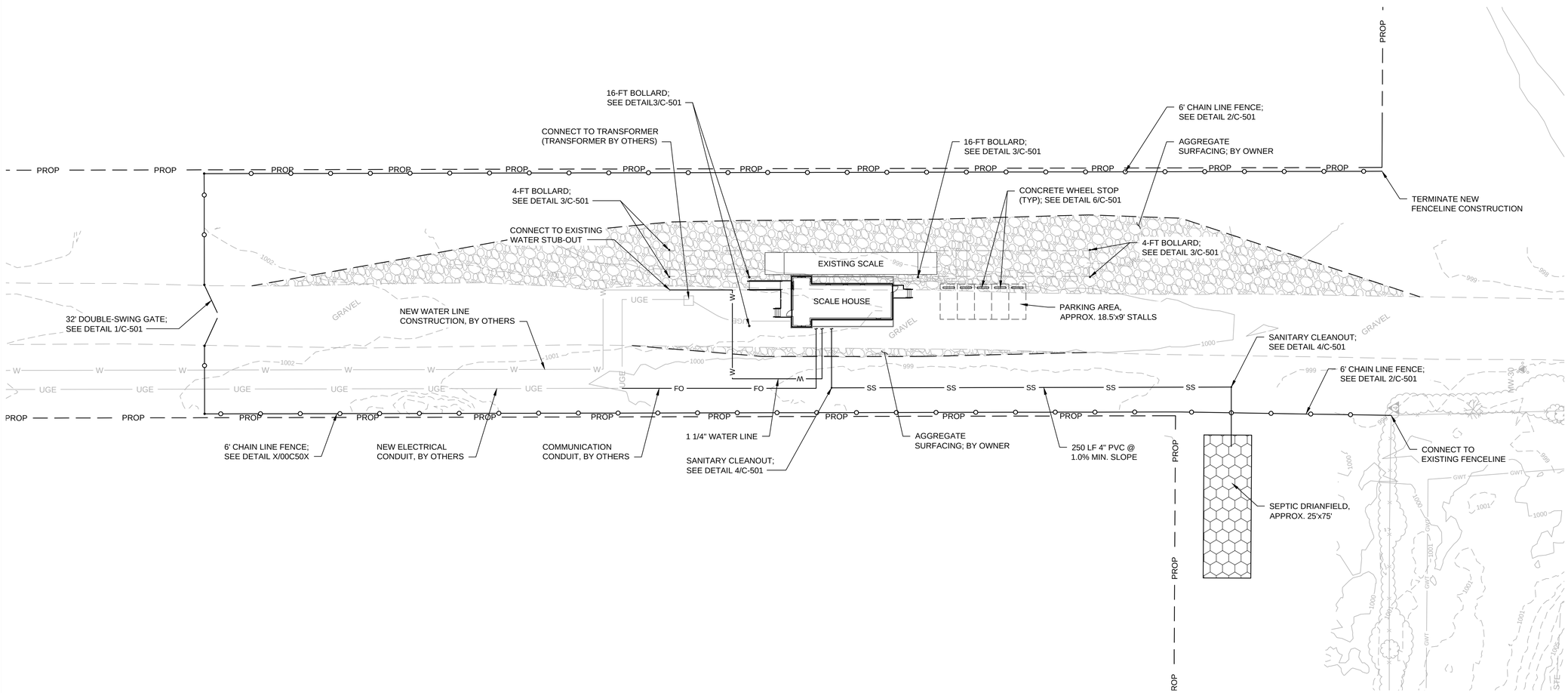
EXISTING CONDITIONS PLAN

0 1" 2"

FILENAME C-101.dwg

SCALE 1" = 80'

SHEET C-101



N

NOTES:

1. EXISTING GRADE FROM AERIAL SURVEY PROVIDED BY AEROVIEW SERVICES, DATED APRIL 26, 2023. CONTOURS DISPLAYED AT 1-FT INTERVALS.
2. UTILITY INFORMATION BASED ON HISTORIC SURVEY AND AS-BUILTS. SUBJECT TO CHANGE BASED ON SITE NEEDS.
3. EXACT PLACEMENT OF IMPROVEMENTS MAY VARY AT THE TIME OF CONSTRUCTION BASED ON FIELD CONDITIONS.
4. FUTURE PROPOSED SCALE LOCATION IS SUBJECT TO CHANGE AND IS NOT INCLUDED IN THIS CONTRACT.
5. SANITARY SEWER TO MAINTAIN A MINIMUM OF 15-FEET OFFSET FROM THE PROPERTY BOUNDARY.

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Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SITE IMPROVEMENTS PLAN

0 1" 2"

FILENAME C-102.dwg
SCALE 1" = 30'

SHEET C-102

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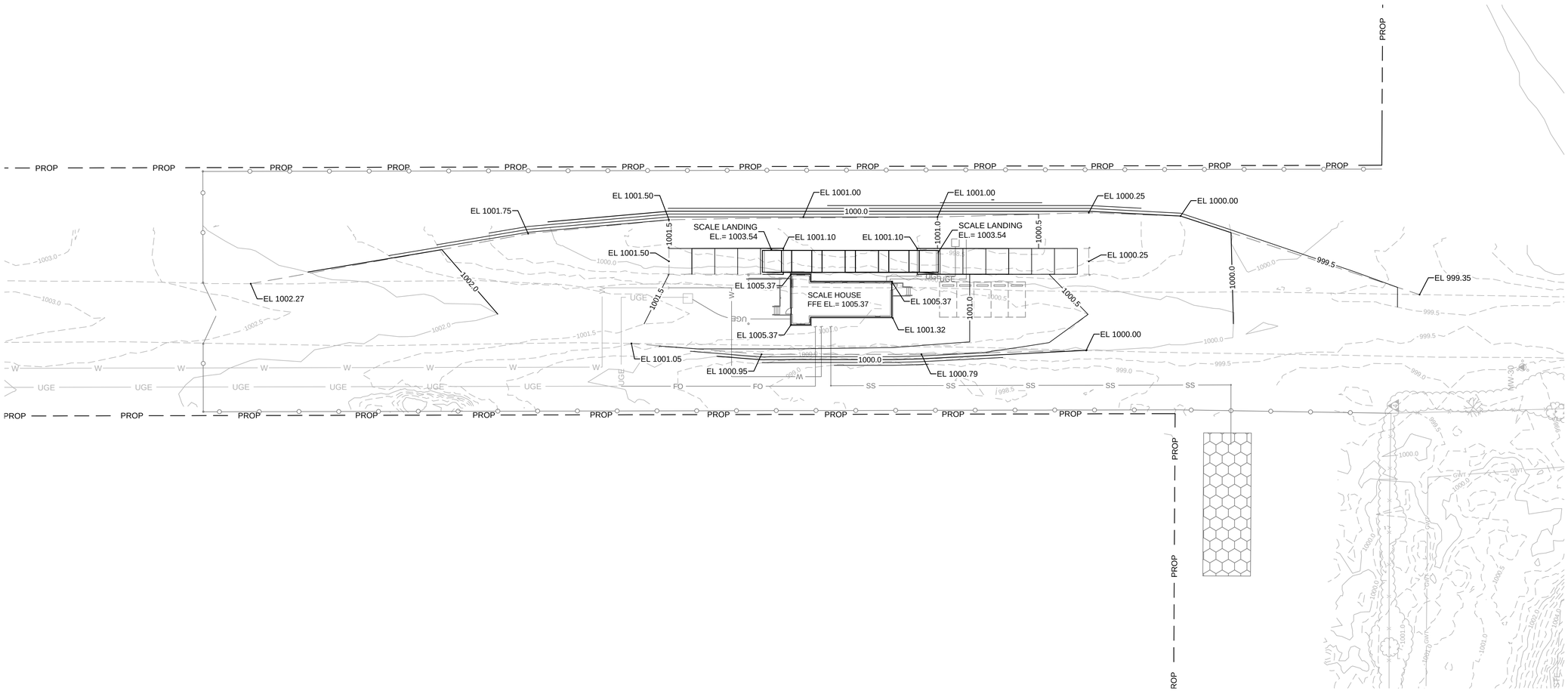

NOTES:

1. EXISTING GRADE FROM AERIAL SURVEY PROVIDED BY AEROVIEW SERVICES, DATED APRIL 26, 2023. CONTOURS DISPLAYED AT 0.25-FT INTERVAL.
2. UTILITY INFORMATION BASED ON HISTORIC SURVEY AND AS-BUILTS. SUBJECT TO CHANGE BASED ON SITE NEEDS.
3. EXACT PLACEMENT OF IMPROVEMENTS MAY VARY AT THE TIME OF CONSTRUCTION BASED ON FIELD CONDITIONS.
4. FUTURE PROPOSED SCALE LOCATION IS SUBJECT TO CHANGE AND IS NOT INCLUDED IN THIS CONTRACT.
5. DESIGN GRADE CONTOURS DISPLAYED AT 0.25-FT AND 1-FT INTERVALS.
6. TOP OF SCALE ELEVATION AT 1003.54 FT.
7. APPROACH RAMP SLOPE AT 4.167%

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Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALEHOUSE PLAZA
GRADING PLAN

0 1" 2"

FILENAME C-103.dwg
SCALE 1" = 30'

SHEET
C-103

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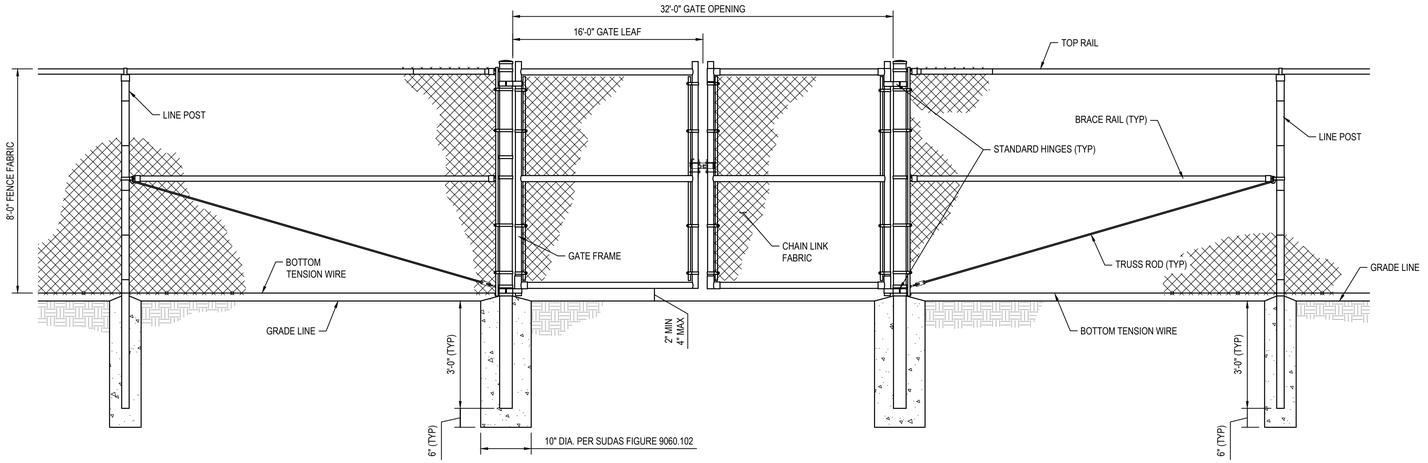
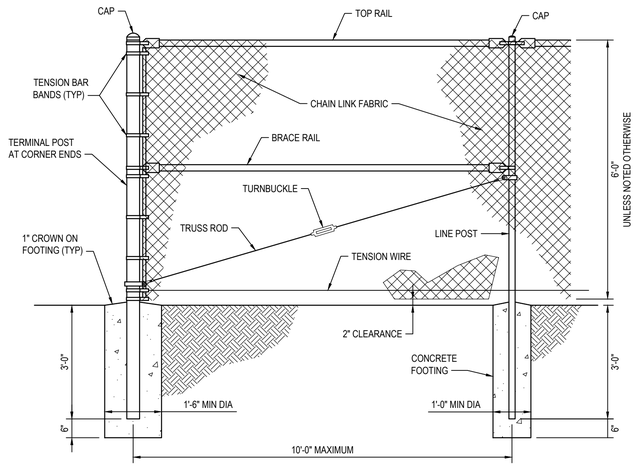


NOTES

1. DETAILS SHOWN ARE TO CLARIFY REQUIREMENTS AND ARE NOT INTENDED TO LIMIT OTHER TYPES OF FENCE SECTIONS AND METHODS OF INSTALLATION.
2. SWING GATES SHALL BE CONSTRUCTED WITH PADLOCKS, AND LATCH ASSEMBLY.
3. ALL GATE FRAMES SHALL BE A MINIMUM 1.90" NOMINAL (ROUND) OR 2.00" NOMINAL (SQUARE). GATE FRAMES SHALL BE OF WELDED CONSTRUCTION OR ASSEMBLED USING HEAVY FITTINGS.

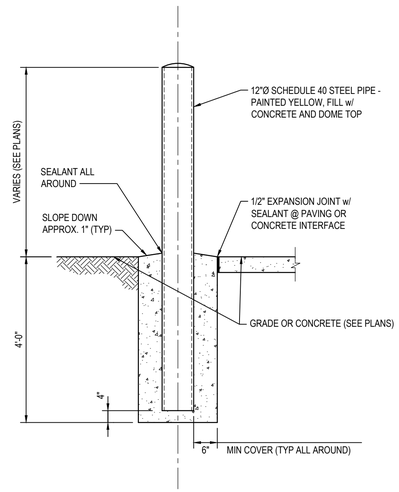
1 C-102 DOUBLE SWING GATE
NO SCALE



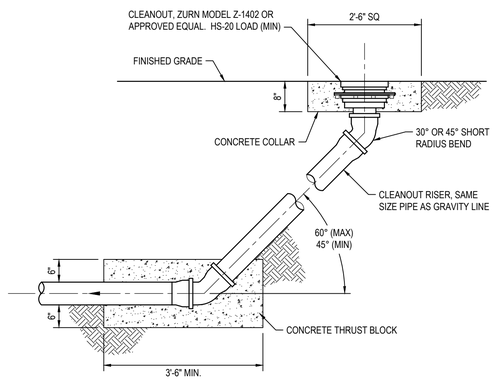
NOTES

1. INSTALL PULL POST AT HORIZONTAL BENDS, SHARP BREAKS IN VERTICAL GRADES, AT SPACED INTERVALS OF APPROXIMATELY 330' ON STRAIGHT RUNS, OR AS APPROVED BY THE ENGINEER.
2. SPLICES IN WOVEN WIRE FABRIC SHALL ONLY BE ALLOWED AT CORNER, GATE END, OR PULL POSTS.
3. PROVIDE EQUAL BRACING ON BOTH SIDES OF CORNER OR PULL POST INSTALLATIONS.
4. SALVAGED FENCE MUST MEET THE REQUIREMENTS OF SPECIFICATION SECTION 02444 IN ORDER TO BE USED.
5. ALL NEW FENCING IS BLACK VINYL COATED.

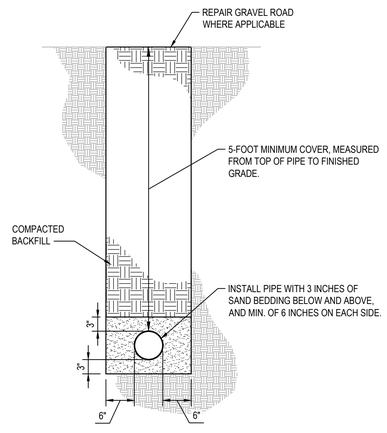
2 C-102 CHAIN LINK FENCE PANEL
NO SCALE



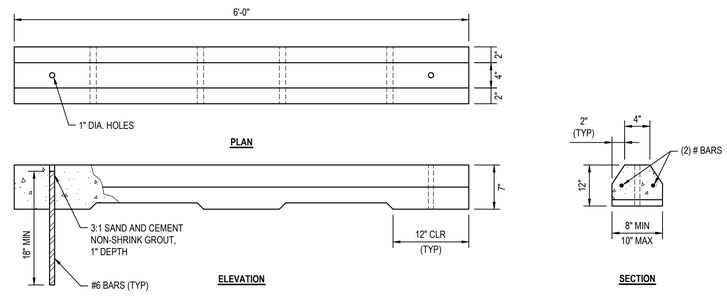
3 C-102 TYPICAL BOLLARD
NO SCALE



4 C-102 GRAVITY SERVICE CLEANOUT
NO SCALE



5 - TYPICAL PIPE BEDDING
NO SCALE



6 C-102 PRE-CAST WHEEL STOP
NO SCALE

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

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PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

CIVIL DETAILS

0 1" 2"

FILENAME C-501.dwg
SCALE AS NOTED

SHEET C-501

GENERAL

G1. SCOPE
THE NOTES ON THIS SHEET AND THE STANDARD STRUCTURAL DETAILS ARE GENERAL AND APPLY TO THE ENTIRE PROJECT WHETHER SPECIFICALLY CALLED OUT OR NOT, EXCEPT WHERE THERE ARE SPECIFIC INDICATIONS TO THE CONTRARY ON STRUCTURAL SHEETS. IF THERE ARE QUESTIONS, THEY SHALL BE SUBMITTED TO THE STRUCTURAL ENGINEER AND ANSWERED IN WRITING PRIOR TO CONSTRUCTION.

G2. APPLICABLE SPECIFICATIONS AND CODES
A. INTERNATIONAL BUILDING CODE, IBC 2015 WITH APPLICABLE EDITIONS OF THE CODE REFERENCED STANDARDS.
B. ACI 318-14
C. ASCE 7-10
D. AISC 360-10
E. NDS 2015

G3. DESIGN CRITERIA
APPLIES TO ALL STRUCTURES (UNO)
A. DEAD LOAD:
A.1. ACTUAL TRIBUTARY STRUCTURE WEIGHT

B. LIVE LOAD:
B.1. SLAB ON GRADE: 100 PSF
B.2. ROOF: 20 PSF (NOT REDUCIBLE)

SEE SPEC FOR ADDITIONAL LOADS

C. WIND:
C.1. BASIC WIND SPEED: 110 MPH
C.2. EXPOSURE: C
C.3. IMPORTANCE FACTOR: 1.0
C.4. ALL STRUCTURES ARE ENCLOSED

D. SEISMIC:
ALL STRUCTURES:
a. OCCUPANCY CATEGORY, II
b. IMPORTANCE FACTOR: 1.0
c. SPECTRAL RESPONSE ACCELERATION, SS = 0.059
d. SPECTRAL RESPONSE ACCELERATION, S1 = 0.048
e. SITE CLASS: D
f. SEISMIC DESIGN CATEGORY: B
g. SPECTRAL RESPONSE COEFFICIENT, SDS = 0.063
h. SPECTRAL RESPONSE COEFFICIENT, SD1 = 0.077
i. BASIC SEISMIC FORCE RESISTING SYSTEM: LIGHT-FRAME (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE
j. DESIGN BASE SHEAR, V: 0.5 KIPS
k. SEISMIC RESPONSE COEFFICIENT, Cs: 0.01
l. RESPONSE MODIFICATION FACTOR, R: 6.5

E. SNOW LOAD:
E.1. GROUND SNOW LOAD = 25 PSF
E.2. FLAT ROOF SNOW LOAD = 17.5 PSF
E.3. EXPOSURE FACTOR = 1.0
E.4. IMPORTANCE FACTOR = 1.0
E.5. THERMAL FACTOR = 1.0
1.2 AT OVERHANGS

G4. THE FOLLOWING NON-CONTRACTUAL GEOTECHNICAL REPORT WAS DEVELOPED FOR THIS PROJECT AND IS THE BASIS OF THIS STRUCTURAL DESIGN:
GEOTECHNICAL FIRM NAME: TEAM SERVICES
ADDRESS: 717 S.E. 6TH STREET, DES MOINES, IA 50309
REPORT NUMBER: 1-5406
REPORT DATE: OCTOBER 31, 2023
ALLOWABLE NET SOIL BEARING = 2000 PSF
FROST DEPTH = 42"

G5. SAFETY
SAFETY AND STRUCTURE STABILITY DURING CONSTRUCTION ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR. STRUCTURES HAVE BEEN DESIGNED TO RESIST THE DESIGN LIVE LOADS ONLY AS A COMPLETED STRUCTURE.

G6. OPENINGS
OPENINGS FOR PIPES, DUCTS, CONDUITS, ETC. ARE NOT ALL SHOWN ON THE STRUCTURAL DRAWINGS. COORDINATE AND PROVIDE OPENINGS AS REQUIRED TO ACCOMMODATE ALL WORK SHOWN OR SPECIFIED IN THE CONTRACT DOCUMENTS AND OTHERWISE REQUIRED FOR THE FURNISHING OF A FUNCTIONALLY COMPLETE PROJECT. REINFORCE AROUND OPENINGS PER STANDARD STRUCTURAL DETAILS UNLESS OTHERWISE SHOWN.

G7. SPECIAL INSPECTIONS
SPECIAL INSPECTIONS ARE REQUIRED IN ACCORDANCE WITH CHAPTER 1 AND CHAPTER 17 OF THE IBC. PAYMENT FOR THESE INSPECTIONS IS NOT THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL PROVIDE FOR FULL ACCESS TO THE WORK BY THE SPECIAL INSPECTOR AND SHALL PROVIDE FOR THESE INSPECTIONS IN HIS CONSTRUCTION SCHEDULE IN ACCORDANCE WITH THE SPECIFICATIONS.

G8. STANDARD DETAILS
THE STANDARD DETAILS DEPICT TYPICAL DETAILING TO BE USED ON THIS PROJECT. IF CONDITIONS ARE NOT EXPLICITLY SHOWN ON THE DRAWINGS THEY SHALL BE MADE SIMILAR TO THE STANDARD DETAILS. OBTAIN APPROVAL OF ENGINEER IN WRITING FOR SIMILAR CONDITIONS PRIOR TO CONSTRUCTION.

G9. CONTRACTOR TO SUBMIT FOR REVIEW ALL EQUIPMENT SIZES, OPERATING WEIGHTS, SUPPORT LOCATIONS, ALONG WITH ANY FLOOR OPENINGS, NOTCHES, AND RECESSES REQUIRED BY SUCH EQUIPMENT. CONCRETE SUPPORT PADS AND/OR FRAMING REQUIRED TO SUPPORT SAID EQUIPMENT SHALL NOT BE FABRICATED AND PLACED UNTIL THE CONCRETE SUPPORT PADS AND/OR FRAMING IS APPROVED TO SUPPORT THE EQUIPMENT.

CONCRETE

C1. DESIGN STRENGTHS:
F'c = 4000 PSI
Fy = 60,000 PSI

C2. CONCRETE COVER
UNLESS OTHERWISE NOTED, PROVIDE CONCRETE COVER FOR REINFORCING AS FOLLOWS:
CONCRETE DEPOSITED AGAINST EARTH: 3"
ALL OTHER: 2"
SEE DRAWINGS FOR EXCEPTIONS

C3. SEE SPECIFICATIONS FOR REINFORCING PLACEMENT REQUIREMENTS.

C4. REFER TO OTHER DISCIPLINE DRAWINGS PRIOR TO CONSTRUCTION FOR EMBEDDED ITEMS AND PENETRATIONS NOT SHOWN ON STRUCTURAL DRAWINGS. AS REQUIRED TO ACCOMMODATE ALL WORK SHOWN OR SPECIFIED IN THE CONTRACT DOCUMENTS AND OTHERWISE REQUIRED FOR THE FURNISHING OF A FUNCTIONALLY COMPLETE PROJECT.REINFORCE AROUND OPENINGS PER STANDARD STRUCTURAL DETAILS UNLESS OTHERWISE SHOWN.

C5. PROVIDE 3/4" CHAMFERS AT ALL EXPOSED EDGES AND 1/2" CHAMFERS AT JOINTS AS SHOWN. NOT ALL CHAMFERS MAY BE SHOWN ON DRAWINGS.

C6. FIELD ADJUST REINFORCING AT OPENINGS AND EMBEDDED ITEMS WHERE INDICATED.

C7. ANCHOR BOLTS NOT SPECIFIED BY ENGINEER SHALL BE DESIGNED AND CERTIFIED BY A REGISTERED PROFESSIONAL ENGINEER, RETAINED BY THE CONTRACTOR, IN ACCORDANCE WITH APPLICABLE PROJECT AND CODE REQUIREMENTS. SUBMIT AS A SHOP DRAWING FOR REVIEW AND APPROVAL BY THE ENGINEER. COORDINATE LOCATION, SIZE AND EMBEDMENT PRIOR TO CASTING CONCRETE.

C8. ABSOLUTELY NO WELDING OF REINFORCING BARS OR TORCHING TO BEND REINFORCING BARS SHALL BE ALLOWED WITHOUT SPECIFIC APPROVAL FROM THE STRUCTURAL ENGINEER.

C9. CONTRACTOR SHALL SUBMIT A CONCRETE PLACEMENT PLAN PER SPECIFICATION 03 31 31 IDENTIFYING JOINT TYPES, JOINT LOCATIONS AND CONCRETE PLACEMENT SEQUENCE.

C10. ALL CAST IN PLACE AND POST-INSTALLED ANCHORS INDICATED IN THE STRUCTURAL DOCUMENTS SHALL COMPLY WITH APPENDIX D OF ACI 318 AND CHAPTER 19 OF THE IBC. ALL EXPANSION AND ADHESIVE ANCHORS SHALL HAVE THE ICC REPORT SHOWING EQUIVALENT LOAD CAPACITY. SUBMIT AND INSTALL PER THE ICC EVALUATION REPORT.

POST-INSTALLED ANCHORS

PA1. POST-INSTALLED ANCHORS SHALL ONLY BE USED WHERE SPECIFIED ON THE CONTRACT DRAWINGS. THE CONTRACTOR SHALL OBTAIN APPROVAL FROM THE ENGINEER OF RECORD (EOR) PRIOR TO INSTALLING POST-INSTALLED ANCHORS FOR MISSING OR MISPLACED CAST-IN-PLACE ANCHORS.

PA2. CARE SHALL BE TAKEN IN PLACING POST-INSTALLED ANCHORS TO AVOID CONFLICTS WITH EXISTING REBAR. HOLES SHALL BE DRILLED AND CLEANED IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.

PA3. SPECIAL INSPECTION SHALL BE PROVIDED FOR ALL ADHESIVE AND MECHANICAL ANCHOR INSTALLATIONS AS REQUIRED BY THE BUILDING CODE. INDEPENDENT ON-SITE PROOF LOAD TESTING SHALL BE PERFORMED AS REQUIRED BY THE EOR. CONTACT THE EOR FOR AMOUNT OF ANCHORS REQUIRED TO BE TESTED AND REQUIRED PROOF LOAD MAGNITUDE.

PA4. REQUESTS FOR PRODUCTS OTHER THAN THOSE LISTED BELOW SHALL BE SUBMITTED FOR APPROVAL ALONG WITH CALCULATIONS SEALED BY A PROFESSIONAL ENGINEER OR OTHER INFORMATION TO DEMONSTRATE THAT THE REQUESTED PRODUCTS ARE EQUAL. THE CALCULATIONS SHALL DEMONSTRATE THAT THE PRODUCT IS CAPABLE OF ACHIEVING EQUIVALENT (MINIMUM) PERFORMANCE VALUES USING APPROPRIATE ANALYSIS METHODS AND PROCEDURES AS REQUIRED BY THE BUILDING CODE. PRODUCT ICC-ES CODE REPORTS SHALL BE INCLUDED WITH THE SUBMITTAL PACKAGE.

UNLESS NOTED OTHERWISE ON PLANS, ACCEPTABLE PRODUCTS SHALL BE:

1. CONCRETE ANCHORS

1.A. MECHANICAL ANCHORS FOR USE IN CRACKED AND UNCRACKED CONCRETE SHALL HAVE BEEN TESTED AND QUALIFIED FOR USE IN ACCORDANCE WITH ACI 355.2 AND ICC-ES AC193. PRE-APPROVED MECHANICAL ANCHORS INCLUDE:
a. SIMPSON STRONG-TIE "STRONG-BOLT" (ICC-ES ESR-1771)
b. SIMPSON STRONG-TIE "TITEN-HD" (ICC-ES ESR-2713)
c. HILTI "HSL-3" (ICC-ES ESR-1545)
d. HILTI "KWIK BOLT TZ" (ICC-ES ESR-1917)

1.B. ADHESIVE ANCHORS FOR USE IN CRACKED AND UNCRACKED CONCRETE SHALL HAVE BEEN TESTED AND QUALIFIED FOR USE IN ACCORDANCE WITH ICC-ES AC308. PRE-APPROVED ADHESIVE ANCHORS INCLUDE:
a. SIMPSON STRONG-TIE "SET-XP" (ICC-ES ESR-2508)
b. HILTI "HIT-RE 500-SD" (ICC-ES ESR-2322)

WOOD ROOF TRUSSES NOTES

1. THE CONTRACTOR SHALL SUBMIT A COMPLETE SET OF CALCULATIONS AND SHOP DRAWINGS OF THE ROOF SYSTEM TO THE ENGINEER FOR REVIEW PRIOR TO FABRICATIONS. THE CALCULATIONS SHALL INCLUDE THE FOLLOWING: TRUSS LAYOUT DRAWING, INDIVIDUAL TRUSS DESIGNS, TEMPORARY BRACING AND PERMANENT BRACING, SHOP DRAWINGS SHALL INDICATE THE TRUSS LAYOUT, TEMPORARY, AND PERMANENT BRACING LOCATIONS. THE CALCULATIONS SHALL INCLUDE THE BRACING MEMBER SIZE, LOCATIONS AND THE POSITIONING OF THE CONNECTOR PLATES. ALL CALCULATIONS AND SHOP DRAWINGS SHALL BE SIGNED AND SEALED BY THE CONTRACTORS LICENSED ENGINEER.
2. WOOD TRUSSES SHALL BE DESIGNED BY THE MANUFACTURER TO RESIST THE LOADS PER THE CODE AND AS SHOWN ON THE TRUSS LOADING DIAGRAMS WHERE SHOWN ON THE DRAWINGS.
3. TRUSSES SHALL BE DESIGNED UNDER THE FOLLOWING FORMAT:
A. LATERAL FORCES APPLIED TO THE TRUSSES SUCH AS DRAG TRUSS LOADS, COLLECTORS, ETC ARE INDICATED ON THE PLANS WHERE APPLICABLE. SEE ADDITIONAL LOADS BELOW.
B. ALL TRUSS TO TRUSS CONNECTIONS ARE THE RESPONSIBILITY OF THE CONTRACTORS ENGINEER.
C. IT IS THE RESPONSIBILITY OF THE CONTRACTORS ENGINEER TO REVIEW ALL OF THE DESIGN SPECIFICATIONS, ROOF TRUSS SUPPORT CONDITIONS, DRAG DETAILS AND TO INCORPORATE THESE REQUIREMENTS INTO THE ENGINEERING DESIGN OF THE TRUSS SYSTEM.
D. THE CONTRACTORS ENGINEER SHALL DEVELOP A TRUSS LAYOUT PLAN FOR THE TRUSS SYSTEM THAT CLEARLY INDICATES THE TRUSS VERTICAL SUPPORT CONDITIONS, TRUSS-TO-TRUSS CONNECTIONS, DRAG TRUSSES AND COLLECTORS, AND ANY OTHER FIELD INSTALLED REINFORCEMENT. INCLUDING FIELD-INSTALLED TOP CHORD REINFORCEMENT AT THE EAVES AS NECESSARY TO EXECUTE THE TRUSS SYSTEM DESIGN. THE TRUSS ROOF FRAMING PLAN SHALL BE SEALED BY THE CONTRACTORS ENGINEER AND SHALL BE INCLUDED WITH THE INDIVIDUAL TRUSS CUT SHEETS. THE CONTRACTORS ENGINEER SHALL ALSO PROVIDE PROPER SUPERVISION OF ANY TRUSS COMPANY TECHNICIANS.
E. DRAG LOADS (HORIZONTAL TRUSS TRANSFERS) CONNECTIONS BETWEEN THE TRUSS AND THE STRUCTURE ARE INDICATED ON THE PLANS WHERE APPLICABLE.
F. ALL TRUSS-TO-STRUCTURE (WALLS OR BEAMS) CONNECTIONS ARE THE RESPONSIBILITY OF THE ENGINEER OF RECORD.
G. TEMPORARY ERECTION BRACING AND PERMANENT WEB BRACING SHALL BE DESIGNED BY THE CONTRACTORS ENGINEER.
4. THE CONTRACTORS ENGINEER SHALL DESIGN ALL APPLIED DEAD, LIVE, WIND, AND SEISMIC LOADS PLUS THE LATERAL SUPPORT LOADS SHOWN ON DRAWINGS. ADDITIONALLY, THE CONTRACTORS ENGINEER WILL BE RESPONSIBLE FOR DESIGNING THE TEMPORARY AND PERMANENT BRACING.
A. MINIMUM TRUSS GRAVITY FRAMING LOADS FOR THE TRUSS DESIGN SHALL BE PER THE TRUSS LOADING DIAGRAMS. SELF WEIGHT OF THE TRUSS OVER 3 PSF SHALL BE ADDED TO THE DEAD LOAD.
5. COORDINATE ADDITIONAL LOADS WITH MECHANICAL AND ELECTRICAL.
A. PROVIDE DOUBLE TRUSSES UNDER ROOF TOP MECHANICAL UNITS, UNLESS NOTED OTHERWISE.

WOOD FRAMING

1. SEE SPECIFICATION SECTION 06 10 00 FOR THE GRADE OF LUMBER TO BE USED FOR ALL WALL FRAMING, BLOCKING, MISC FRAMING.
2. FOR CONNECTIONS NOT DETAILED, REFERENCE IBC TABLE 23.04.9.1 FOR TYPICAL WOOD ADJACENT TO CONCRETE.

WOOD STRUCTURAL SHEATHING NOTES

1. WALL SHEATHING SHALL BE SHEATHING GRADE, 1/2 PERFORMANCE CATEGORY WITH A MINIMUM SPAN RATING OF 32/16 AND SHALL BE ATTACHED WITH 0.148" COMMON NAILS AS FOLLOWS UNLESS SHOWN OTHERWISE:
6" OC @ ALL SUPPORTED PANEL EDGES
12" OC @ INTERMEDIATE SUPPORTS
PROVIDE FULL DEPTH BLOCKING AT ALL UNBLOCKED EDGES OF SHEATHING. PROVIDE MINIMUM ONE HORIZONTAL ROW OF BLOCKING AT MID HEIGHT OF WALL STUDS.
2. ROOF SHEATHING SHALL BE SHEATHING GRADE, EXTERIOR EXPOSOSURE RATING, WITH A MINIMUM SPAN RATING OF 32/16, A MINIMUM THICKNESS OF 1/2" AND SHALL BE ATTACHED WITH COMMON NAILS PER PLYWOOD CONNECTION SCHEDULE. PROVIDE FULL DEPTH BLOCKING AT ALL UNBLOCKED EGDE OF SHEATHING.

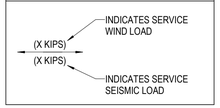
SPECIAL STRUCTURAL INSPECTIONS

1. SPECIAL INSPECTIONS AND TESTS SHALL BE BY AN INDEPENDENT TESTING AND INSPECTION AGENCY EMPLOYED BY THE CONTRATOR AND APPROVED BY THE CONTRATING OFFICER. TEST AND INSPECTION REPORTS SHALL BE SUBMITTED FOR REVIEW TO THE CONTRACTING OFFICER.
2. SPECIAL INSPECTIONS AND TESTS SHALL BE PERFORMED DURING CONSTRUCTION IN ACCORDANCE WITH CHAPTER 17 AND CHAPTER 1, SECTION 110 OF THE 2021 INTERNATIONAL BUILDING CODE, SCHEDULE OF INSPECTIONS, AND THE CONTRACT SPECIFICATIONS. THE CONTRACTOR SHALL NOTIFY AND ACCOMMODATE THE APPLICABLE INSPECTOR DURING APPROPRIATE PHASES OF THE WORK AS REQUIRED BY EACH TEST AND INSPECTION.
3. SPECIAL INSPECTION, SEE SPECIFICATION SECTION 01 45 35, SPECIAL INSPECTIONS AND THE SCHEDULE OF SPECIAL INSPECTIONS.

DEFERRED SUBMITTALS

SPECIFICATION SECTION	ITEM
06 17 53	PRE-FABRICATED WOOD TRUSSES
OTHER	ANY EQUIPMENT IN WHICH A TECHNICAL SPECIFICATION REQUIRES SUBMITTAL OF EQUIPMENT OR ANCHORAGE SYSTEM.

DRAG TRUSS SYMBOL LEGEND



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ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
STRUCTURAL NOTES

0 1" 2"
FILENAME 10386668-G.rvt
SCALE 12" = 1'-0"

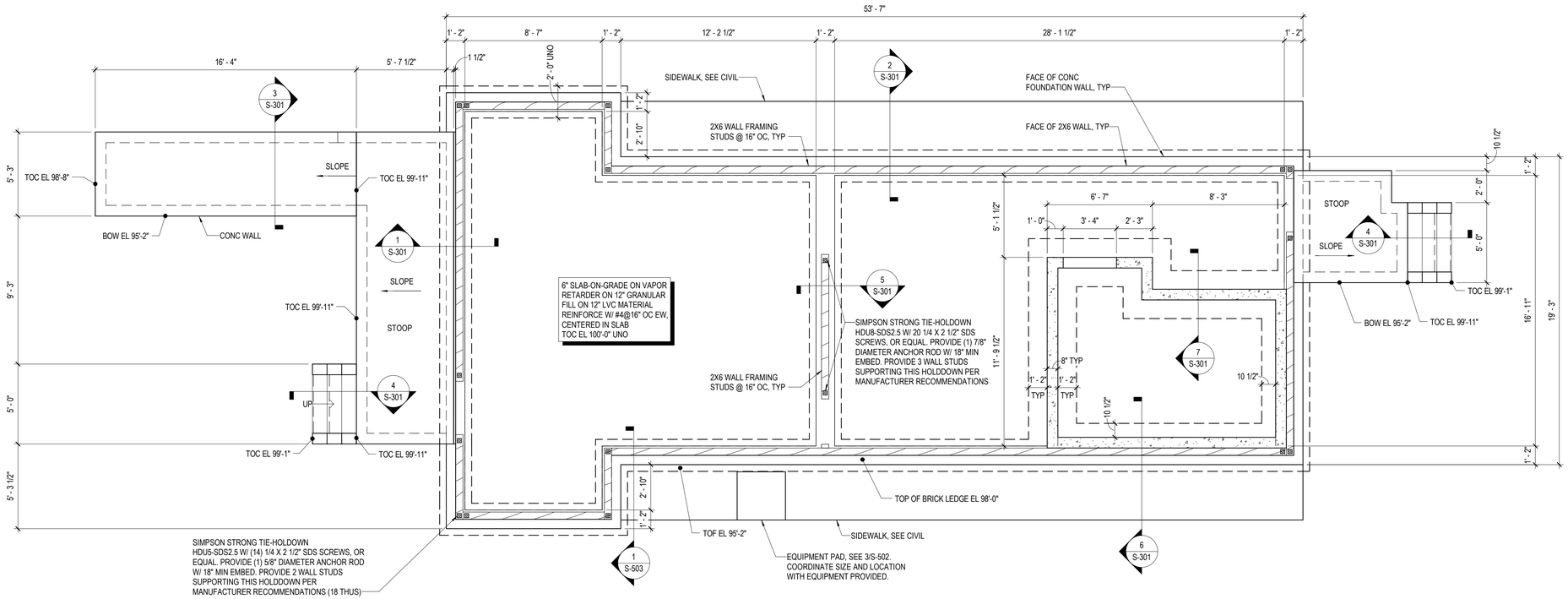
SHEET
S-001

GENERAL NOTES

1. FOR GENERAL STRUCTURAL NOTES, SEE SHEET S-001.
2. FOR STANDARD DETAILS, SEE SERIES S-50X.

SHEET NOTES

1. ARCHITECTURAL EL=100'-0" EQUAL CIVIL EL = 1005.37'
2. SEE MECH/PLUMBING SHEETS FOR ADDITIONAL INFORMATION ON FLOOR PENETRATIONS.
3. ALL FRAMING TO BE SPRUCE-PINE-FIR NO.1/NO.2 UNLESS NOTED OTHERWISE. WOOD IN CONTACT WITH CONCRETE TO BE GREEN PRESSURE TREATED.



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PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
STRUCTURAL FOUNDATION PLAN

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 1/4" = 1'-0"

SHEET S-101

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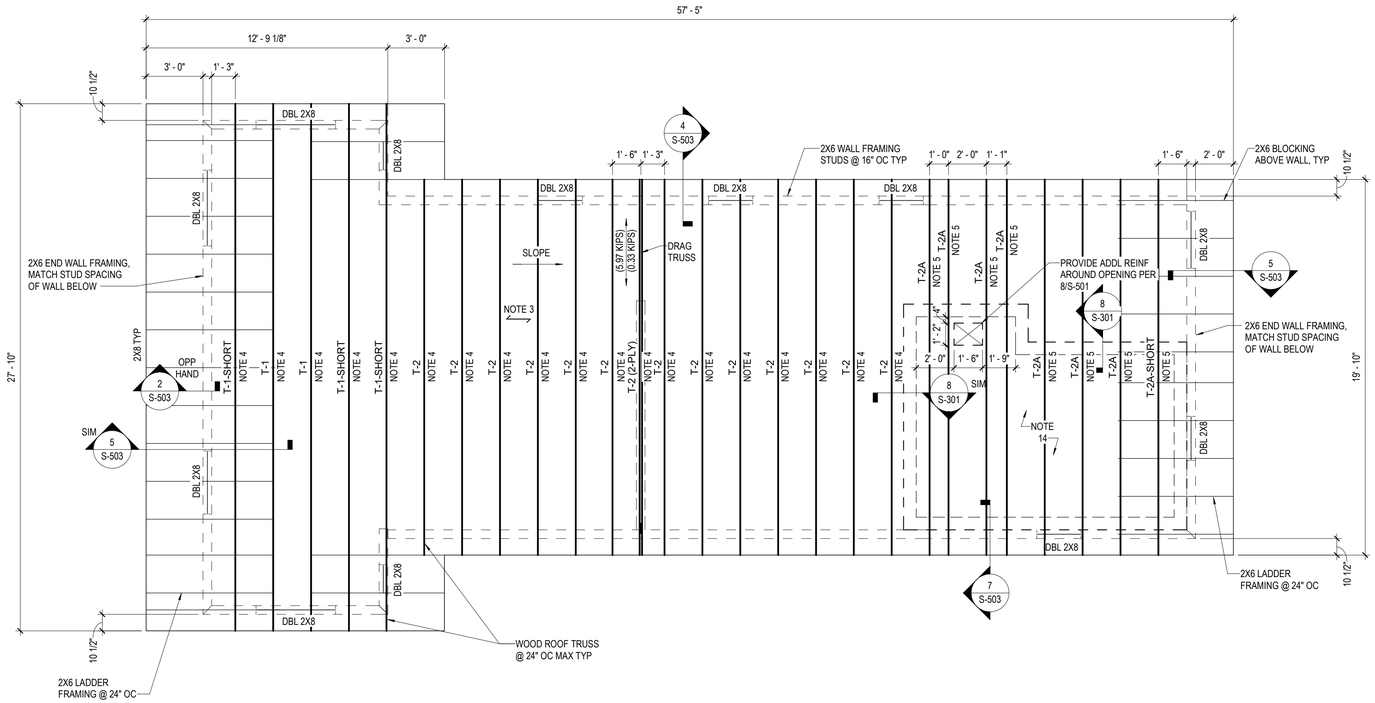
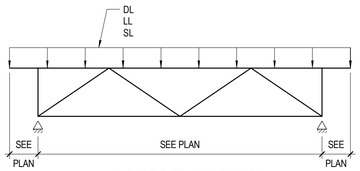




TRUSS T-1/T-2/T-2A

(LOOKING PLAN EAST)

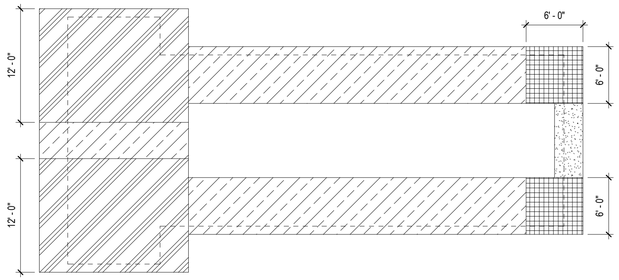
GENERAL NOTES:

DL 34 PSF (22 PSF TOP CHORD AND 12 PSF BOTTOM CHORD)
LL 20 PSF
SL 26 PSF

1. DEAD LOAD DOES NOT INCLUDE SELF WEIGHT OF TRUSS.
2. TRUSS MANUFACTURER TO INCLUDE OUTRIGGER LOADS TO ASSOCIATED TRUSSES SHOWN ON PLANS.
3. TRUSS TO TRUSS LOADS AND CONNECTIONS BY TRUSS SUPPLIER.
3. SEE PRE-ENGINEERED WOOD TRUSS WIND UPLIFT DIAGRAM FOR TRUSS WIND UPLIFT PRESSURES.

1 TRUSS LOADING DIAGRAMS

3/4" = 1'-0"



SYMBOL	LOAD (PSF)
	-28.6
	-31.6
	-35.4
	-38.3
	-47.2

NOTES:

1. ALL WIND LOADS LISTED ARE GROSS PRESSURES AND ULTIMATE (1.0WL).

2 WOOD TRUSS UPLIFT DIAGRAM

1/8" = 1'-0"

GENERAL NOTES

1. FOR GENERAL STRUCTURAL NOTES, SEE SHEET S-001.
2. FOR STANDARD DETAILS, SEE SERIES S-50X.

SHEET NOTES

1. TX INDICATES THE TRUSS TYPE, SEE TRUSS LOADING DIAGRAMS THIS SHEET FOR LOADING. -SHORT INDICATES DROP TRUSS AT LADDER FRAMING.
2. SLOPE INDICATES SLOPE DOWN DIRECTION OF ROOF TRUSSES.
3. INDICATES SPAN DIRECTION OF PLYWOOD PANEL.
4. WOOD ROOF TRUSS TO BEAR ON TOP OF STUD WALL EL = 109'-1 1/8".
5. WOOD ROOF TRUSS TO BEAR ON TOP OF STUD WALL EL = 109'-8 1/8", SEE DETAIL 7/S-503 FOR ADDITIONAL INFORMATION.
6. PRE-ENGINEERED TRUSSES SHALL BE DESIGNED BY TRUSS MANUFACTURER AND STAMPED BY A LICENSED ENGINEER IN THE STATE OF IOWA.
7. SEE 6/S-503 FOR SHEATHING CONNECTION REQUIREMENTS.
8. TEMPORARY AND PERMANENT BRACING NOT SHOWN. SIZES AND LOCATIONS OF BRACING TO BE DESIGNED BY TRUSS MANUFACTURER AND SUBMITTED ON SHOP DRAWING PRIOR TO CONSTRUCTION FOR REVIEW.
9. DBL 2X8 = DOUBLE 2X8 LINTEL @ DOOR AND WINDOW OPENINGS. SEE DETAIL 3/S-503.
10. BRIDGING LAYOUT AND SIZING TO BE DESIGNED BY TRUSS MANUFACTURER.
11. DOUBLE TOP PLATE SPLICES TO OCCUR NOT MORE THAN 12 FEET AWAY FROM CORNERS OF DIAPHRAGM. STAGGER SPLICES 5'-6" MIN IN DOUBLE TOP PLATE.
12. PROVIDE 10- 10d NAILS ON EACH SIDE OF EACH SPLICE IN THE DOUBLE TOP PLATE.
13. COORDINATE LAYOUT OF WOOD TRUSS WEB MEMBERS WITH MECH DUCTWORK AS REQUIRED.
14. 6" NW CONCRETE LID. REINFORCE W/ #5@12 EW T&B. TOC EL = 109'-7" UNO. INNER BARS RUN PLAN EAST-WEST.

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FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

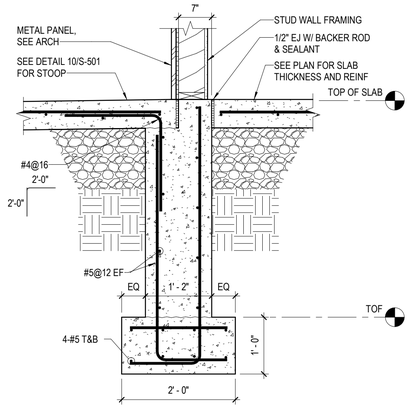
Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
STRUCTURAL ROOF FRAMING PLAN

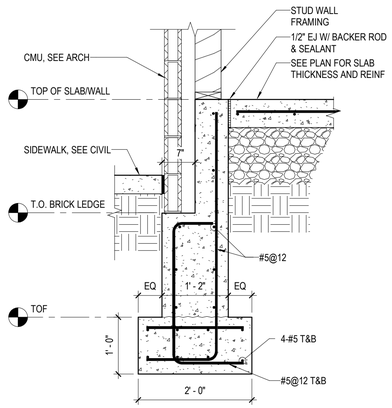
0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE As indicated

SHEET S-102



1 S-101 SECTION
3/4" = 1'-0"



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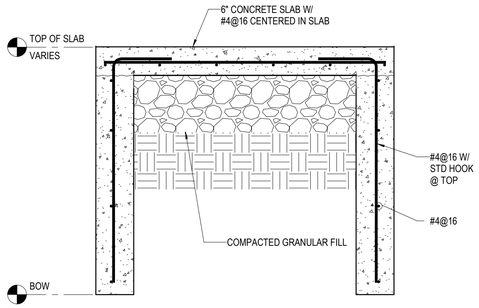
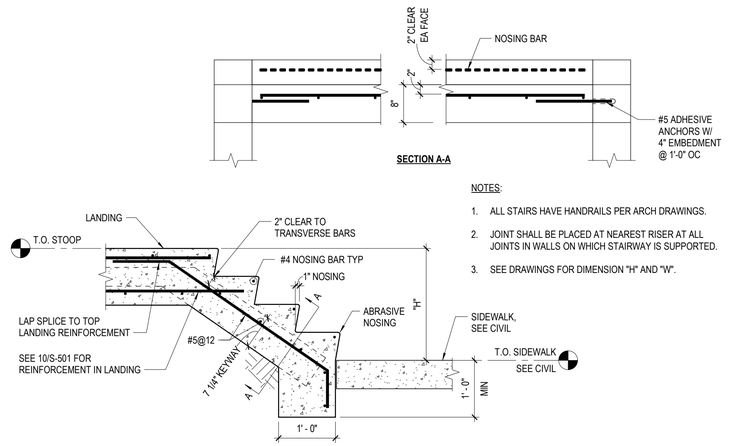
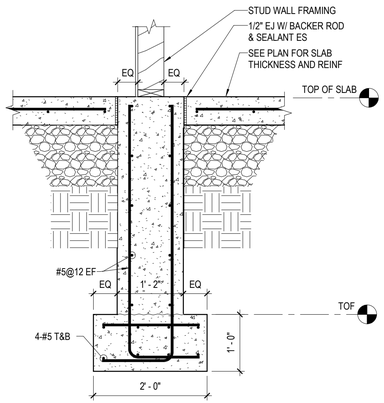
3/4" = 1'-0"



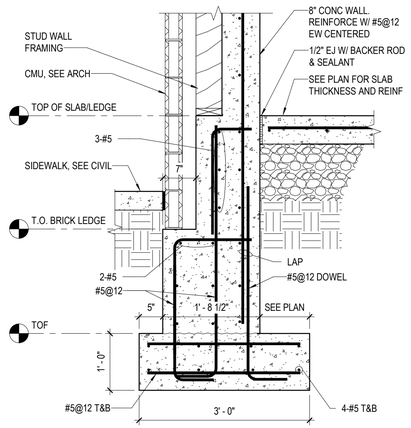
3 S-101 SECTION
3/4" = 1'-0"



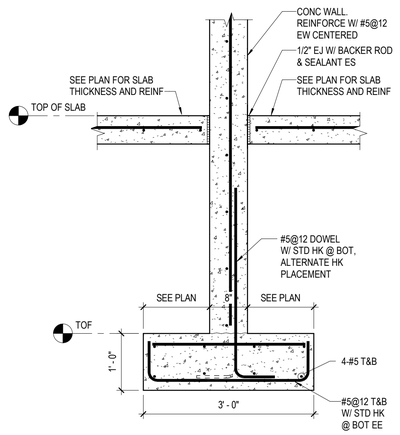
4 S-101 CONCRETE STAIR ON GRADE
3/4" = 1'-0"



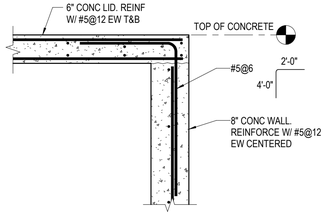
5 S-101 SECTION
3/4" = 1'-0"



6 S-101 SECTION
3/4" = 1'-0"



7 S-101 SECTION
3/4" = 1'-0"



NOTE:
1. TRUSSES NOT SHOWN FOR CLARITY.

8 S-102 SECTION
3/4" = 1'-0"

HDR

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ARCHITECT	RANDALL MILBRATH
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Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
STRUCTURAL SECTIONS

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 3/4" = 1'-0"

SHEET
S-301

EQUIVALENT BAR SIZES	
METRIC	INCH-POUND
#10	#3
#13	#4
#16	#5
#19	#6
#22	#7
#25	#8
#29	#9
#32	#10
#36	#11
#43	#14
#57	#18
GRADE 420	GRADE 60

NOTE:

1. BAR SIZES NOTED ON DRAWINGS ARE GIVEN IN "INCH-POUND" BAR SIZES. EQUIVALENT "METRIC BARS" HAVING THE SAME PHYSICAL SIZE AND MINIMUM YIELD STRENGTH MAY BE SUBSTITUTED PER THE TABLE ABOVE.

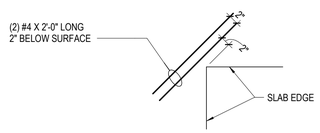
1 REINFORCING BAR SIZE SCHEDULE
NOT TO SCALE

LAP SPLICE AND EMBEDMENT LENGTHS f'c =4.0 ksi or 6.0 ksi fy = 60 ksi		
BAR	BARS SPACED GREATER THAN 4"	BARS SPACED LESS THAN OR EQUAL TO 4"
#3	14"	20"
#4	19"	32"
#5	29"	46"
#6	39"	62"
#7	55"	87"
#8	69"	107"
#9	76"	116"
#10	97"	140"
#11	120"	146"

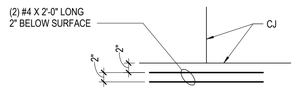
NOTES:

1. PROVIDE MINIMUM LAP SPLICE LENGTHS AND EMBEDMENTS PER TABLE UNLESS NOTED OTHERWISE. EMBEDMENT LENGTH EQUALS THE LAP SPLICE LENGTH UNLESS OTHERWISE NOTED.
2. BAR SPACING AT LAP SPLICE IS THE MINIMUM CLEAR DISTANCE BETWEEN LAPPED BARS PLUS ONE BAR DIAMETER.
3. ALL SPLICES TO BE CONTACT SPLICES AND WIRED TOGETHER UNLESS OTHERWISE APPROVED BY ENGINEER.
4. NO WELDED OR MECHANICAL SPLICES ARE PERMITTED UNLESS NOTED OTEHRWISE.
5. UNLESS OTHERWISE SHOWN, SPLICES FOR BOTTOM REINFORCING BARS IN BEAMS AND SLABS SHALL BE CENTERED OVER THE SUPPORTS. SPLICES FOR TOP REINFORCING BARS SHALL BE LOCATED AT CENTERLINE OF SPAN.

2 REINFORCING LAP AND EMBEDMENT SCHEDULE
NOT TO SCALE

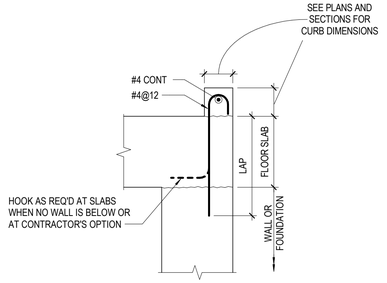


INTERNAL CORNER

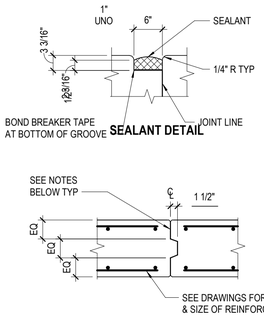


DISCONTINUOUS JOINT INTERSECTION

3 TYP RE-ENTRANT CORNER DETIL
NOT TO SCALE

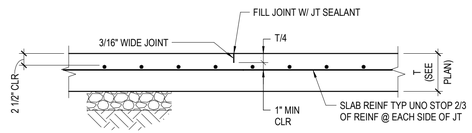


4 TYPICAL CURB DETAIL
NOT TO SCALE

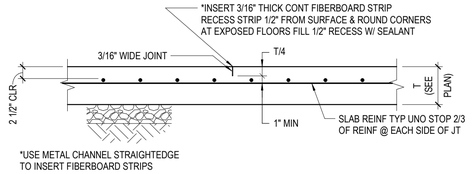


NON-WATER BEARING SLAB OR WALL 10" THICK OR GREATER

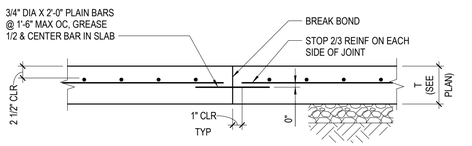
5 WALL CONTROL JOINT (CJ)
NOT TO SCALE



SAWED CONTROL JOINT



FORMED CONTROL JOINT

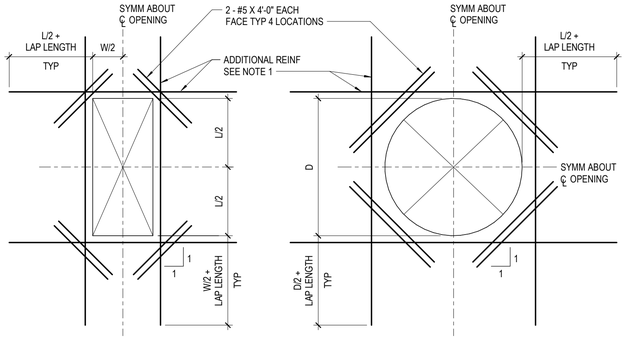


DOWELLED CONSTRUCTION JOINT (DSJ)

NOTE:

1. ANY ONE OF THE DETAILS ABOVE MAY BE USED AT LOCATIONS INDICATED ON DRAWINGS AS "SJ," AT CONTRACTOR'S OPTION.
2. WHERE "DSJ" IS INDICATED ON PLAN, THE "DSJ" SHALL BE USED.

7 SLAB-ON-GRADE JOINT (SJ)
NOT TO SCALE

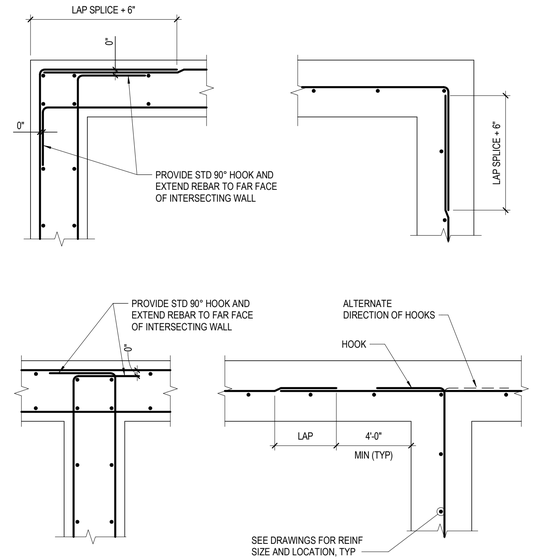


RECTANGULAR OPENING DETAIL — CIRCULAR OPENING DETAIL

NOTES:

1. PROVIDE ADDITIONAL REINFORCING THE SAME SIZE AS DISCONTINUOUS REINFORCEMENT AT OPENING. QUANTITY OF REINFORCING IN EACH DIRECTION SHALL BE EQUAL TO OR ONE GREATER THAN THE NUMBER OF DISCONTINUOUS BARS. PLACE 1/2 OF ADDITIONAL REINFORCING BARS EACH SIDE OF OPENING. PLACE ADDITIONAL REINFORCEMENT AT 3" OC (TYPICAL BOTH DIRECTIONS AND ALL LAYERS OF REINFORCEMENT). START FIRST BAR 2" CLEAR TO OPENING.
2. EXTEND ADDITIONAL REINFORCING BEYOND EDGE OF OPENING AS SHOWN ABOVE. ADDITIONAL BARS MAY TERMINATE AT THE END OF THE WALL WITH A STANDARD HOOK WHERE THE LENGTH OF THE WALL WILL NOT PERMIT BARS TO EXTEND AS SHOWN ABOVE.
3. TYPICAL WALL OR SLAB REINFORCING NOT SHOWN FOR CLARITY. TERMINATE TYPICAL REINFORCING 2" CLEAR TO OPENING.
4. OPENINGS 12" OR LESS IN SLABS AND OPENINGS 18" OR LESS IN WALLS, NO EXTRA REBARS ARE REQUIRED UNLESS SHOWN OTHERWISE. TYPICAL REINFORCING SHALL BE RESPACED (NOT CUT) TO ALLOW FOR OPENINGS TO BE MADE.
5. UNLESS SHOWN OTHERWISE ON DRAWINGS, PROVIDE EXTRA REINFORCING AROUND OPENINGS AS SHOWN AND INDICATED ABOVE.
6. PROVIDE ADDITIONAL DOWELS PER NOTE 1 ABOVE FOR ALL OPENINGS NEAR THE FLOOR SLAB, BASE SLAB, OR CORNERS.

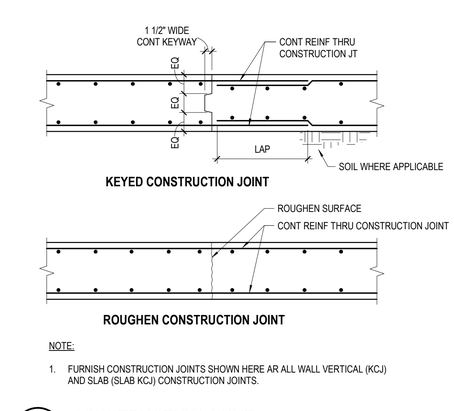
8 EXTRA REINFORCEMENT AROUND OPENINGS
NOT TO SCALE



NOTES:

1. ALL HOOKS SHALL BE STD 90 DEGREE HOOKS.
2. SEE DRAWINGS FOR ADDITIONAL HORIZONTAL BARS. STAGGER BETWEEN TYPICAL REINF SPACING.

9 TYPICAL WALL REINFORCEMENT AT CORNERS & INTERSECTIONS
NOT TO SCALE



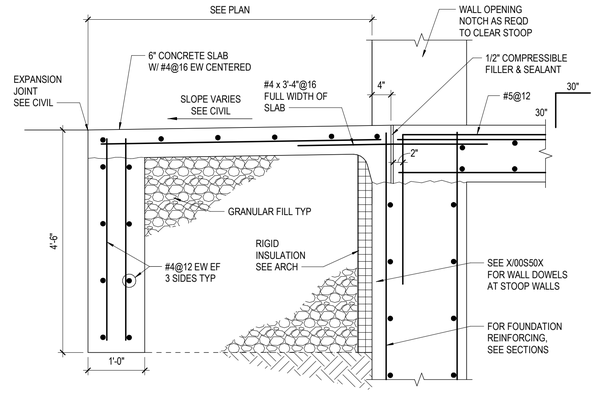
KEYED CONSTRUCTION JOINT

ROUGHEN CONSTRUCTION JOINT

NOTE:

1. FURNISH CONSTRUCTION JOINTS SHOWN HERE AR ALL WALL VERTICAL (KCJ) AND SLAB (SLAB KCJ) CONSTRUCTION JOINTS.

6 CONSTRUCTION JOINT
NOT TO SCALE



10 DOOR STOOP
NOT TO SCALE

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ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

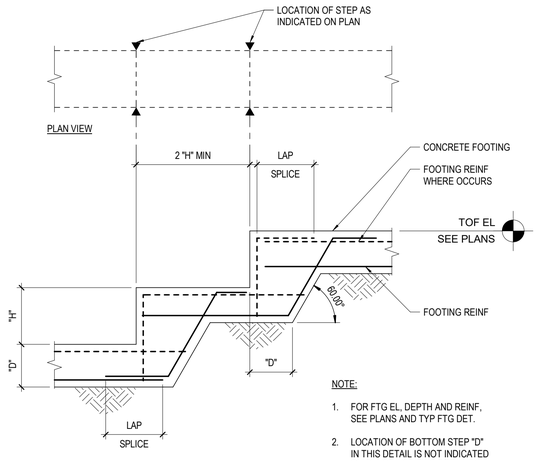
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
TYPICAL STRUCTURAL DETAILS

0 1" 2"

FILENAME 10386668-G.rvt
SCALE As indicated

SHEET
S-501

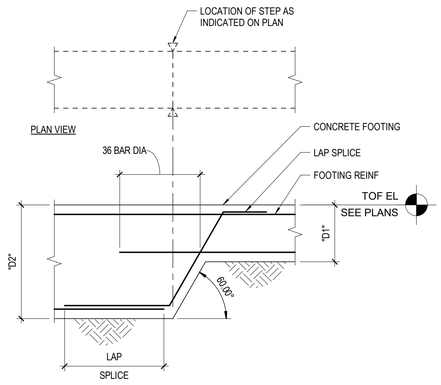


NOTE:

1. FOR FTG EL, DEPTH AND REINF, SEE PLANS AND TYP FTG DET.
2. LOCATION OF BOTTOM STEP "D" IN THIS DETAIL IS NOT INDICATED ON PLANS. USE THIS DETAIL TO DETERMINE LOCATION.

1 TYPICAL STEP FOOTING

NOT TO SCALE

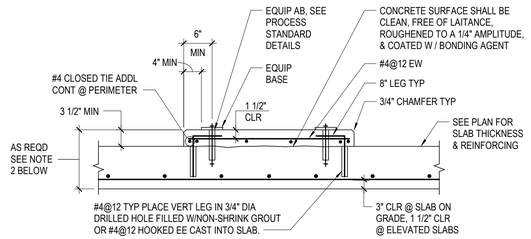


NOTE:

1. FOR FTG EL, DEPTH AND REINF, SEE PLANS AND TYP FTG DET.

2 BOTTOM STEP FOOTING 1 BOTTOM STEP

NOT TO SCALE

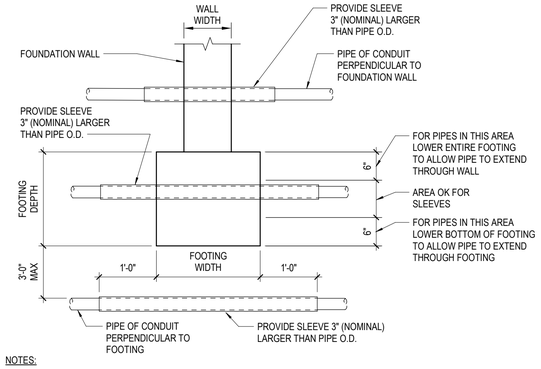


NOTES:

1. PROVIDE ABOVE PAD UNDER ALL ELECTRICAL AND MECHANICAL EQUIPMENT SUPPORTED ON STRUCTURAL SLABS. ALSO PROVIDE FOR EQUIPMENT WEIGHING LESS THAN 5000 POUNDS WHICH ARE SUPPORTED ON GRADE OR WHERE SPECIFICALLY NOTED ON PLANS.
2. PAD THICKNESS SHALL BE THE LARGER OF SLAB THICKNESS PLUS 3 1/2" OR MINIMUM PAD THICKNESS FROM TABLE SHOWN ON DETAIL 11 THIS SHEET. PROVDE AN ADDITIONAL LAYER OF #4@12 EACH WAY WITH 1 1/2" CLEAR TOP AND BOTTOM FOR EACH 8" ADDITIONAL PAD THICKNESS EXCEEDING THE 3 1/2" MINIMUM THICKNESS. ALTERNATIVELY, THICKEN SLAB ON GRADE BELOW EQUIPMENT PAD AS REQD TO MAINTAIN MIN 3" COVER ON ANCHOR BOLTS.

3 EQUIPMENT SUPPORT PAD (TYPE A)

NOT TO SCALE

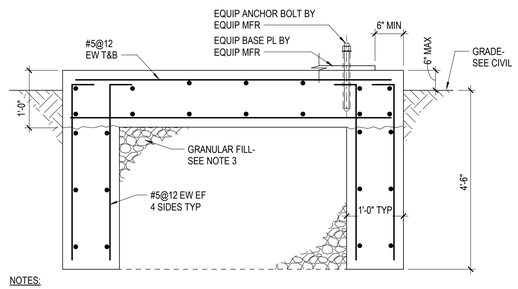


NOTES:

1. FOR PIPES 3'-0" OR LESS BELOW FOOTING, PROVIDE SLEEVES AS SHOWN.
2. FOR PIPES AND CONDUITS MORE THAN 3'-0" BELOW FOOTING, PIPE SLEEVE MAY BE ELIMINATED.
3. COORDINATE WITH MECH, ELECT AND OTHER AFFECTED TRADES.
4. PROVIDE SLIP JOINTS AND/OR BALL JOINTS AS REQ'D FOR AN ESTIMATED 1.8 PVM THERE IS SHRINK SWELL POTENTIAL DUE TO CLAY SOILS PRESENT AT THIS SITE.
5. FOR PIPES PENETRATING THE FOOTINGS OR FOUNDATION WALLS THE PIPE CAN BE TERMINATED T THE FACE OF THE FOOTING OR FOUNDATION WALL; THE ONE FOOT PROJECTION BEYOND THE FACE OF THE CONCRETE ONLY APPLIES TO PIPES INSTALLED LESS THAN 3'-0" BELOW THE BOTTOM OF FOOTINGS.

4 INSTALLATION OF PIPES AND CONDUITS

NOT TO SCALE

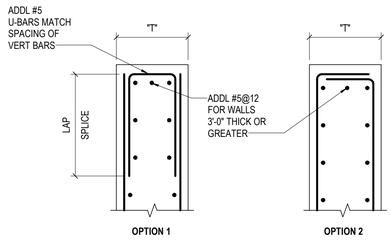


NOTES:

1. SEE PAD NOTES AT DETAIL 1 THIS SHEET.
2. INCREASE SLAB THICKNESS AS REQUIRED TO MAINTAIN MINIMUM 3" CONCRETE COVER BELOW EQUIPMENT ANCHOR BOLTS. WEIGHING MORE THAN 5000 POUNDS AND SUPPORTED ON GRADE UNLESS NOTED OTHERWISE ON PLANS.
3. AT CONTRACTOR'S OPTION REPLACE GRANULAR FILL WITH CONCRETE POURED WITH PERIMETER GRADE BEAM AND TOP SLAB. PROVIDE ALL REINF SHOWN IN SECTION.
4. PROVIDE OPENINGS AS REQD FOR PENETRATIONS. REINFORCE AROUND OPENINGS PER X/00S50X.

5 EXTERIOR EQUIPMENT PAD

NOT TO SCALE

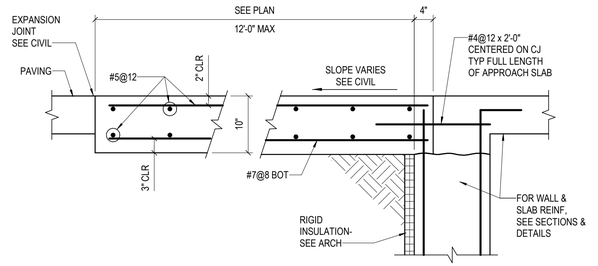


NOTES:

1. FOR TYPICAL REINFORCEMENT, SEE PLANS, DETAILS & SCHEDULES.
2. TERMINATE TYPICAL REINFORCEMENT WITH END HOOK (OPTION-2) OR ADDITIONAL U BARS (OPTION-1).
3. THIS DETAIL TO BE USED ONLY WHEN A SPECIAL DETAIL IS NOT PROVIDED ON PLAN SHEETS.
4. PROVIDE EXTRA REINFORCING AROUND OPENINGS PER DETAIL X/00S50X.
5. DETAIL SIMILAR AT HEAD AND SILL OF OPENINGS.

6 TOP OR END OF WALL (t >/= 1'-4")

NOT TO SCALE



7 APPROACH SLAB

NOT TO SCALE

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A	06/14/2024	ISSUED FOR BID

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ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

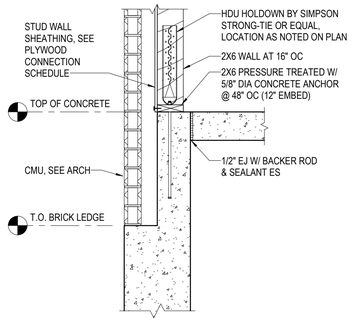
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
TYPICAL STRUCTURAL DETAILS

0 1" 2"

FILENAME 10386668-G.rvt
SCALE As indicated

SHEET S-502

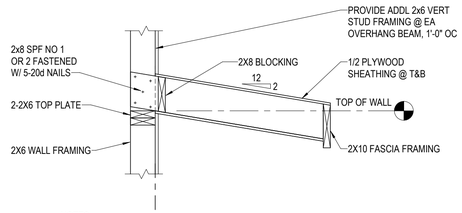


NOTE:

1. REINFORCING NOT SHOWN FOR CLARITY.

1 SECTION

3/4" = 1'-0"

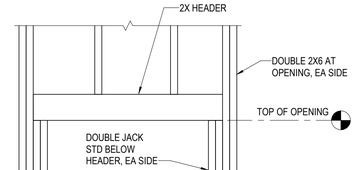


NOTES:

1. SEE PLYWOOD CONNECTION SCHEDULE FOR FASTENING TO WALLS AND BLOCKING.
2. SEE ARCH FOR ADDITIONAL ASSEMBLY DETAILS.

2 ROOF FRAMING DETAIL

3/4" = 1'-0"

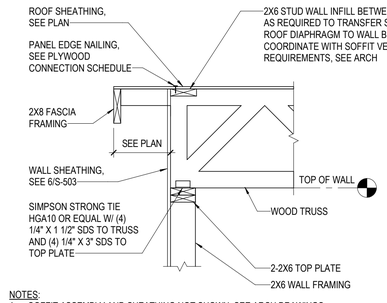


NOTES:

1. THIS DETAIL APPLIES TO WINDOW AND DOOR OPENINGS UNLESS NOTED OTHERWISE.
2. 2X HEADERS TO BE FASTENED TOGETHER W/ 10d NAILS STAGGERED @ 16" OC FACE NAILED T&B.

3 HEADER DETAIL

3/4" = 1'-0"

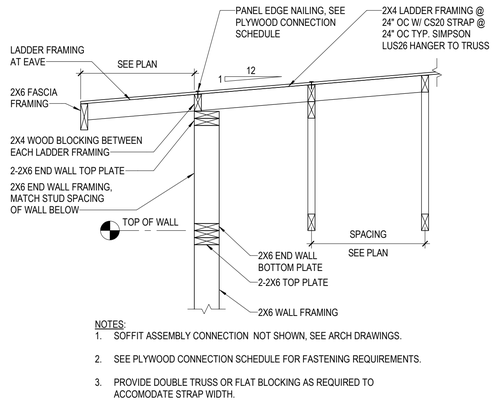


NOTES:

1. SOFFIT ASSEMBLY AND SHEATHING NOT SHOWN, SEE ARCH DRAWINGS.
2. SEE PLYWOOD CONNECTION SCHEDULE FOR FASTENING REQUIREMENTS.
3. COORDINATE FASTENER REQUIRED FOR ATTACHMENT OF SIMPSON CONNECTORS TO STRUCTURE TYP.
4. AT CONDITION WHERE TRUSS FRAMING IS PARALELL TO WALL, PROVIDE SIMPSON STRONG TIE HGA10 OR EQUAL W/ (4) 1/4" X 1 1/2" SDS TO TRUSS AND (4) 1/4" X 3" SDS TO TOP PLATE.

4 TYPICAL FRAMING CONNECTION AT WALL

3/4" = 1'-0"



NOTES:

1. SOFFIT ASSEMBLY CONNECTION NOT SHOWN, SEE ARCH DRAWINGS.
2. SEE PLYWOOD CONNECTION SCHEDULE FOR FASTENING REQUIREMENTS.
3. PROVIDE DOUBLE TRUSS OR FLAT BLOCKING AS REQUIRED TO ACCOMODATE STRAP WIDTH.
4. COORDINATE FASTENER REQUIRED FOR ATTACHMENT OF SIMPSON CONNECTORS TO STRUCTURE TYP.
5. VERIFY SIZES.
6. SEE PLAN FOR TRUSS TYPE.

5 ENDWALL SECTION

3/4" = 1'-0"

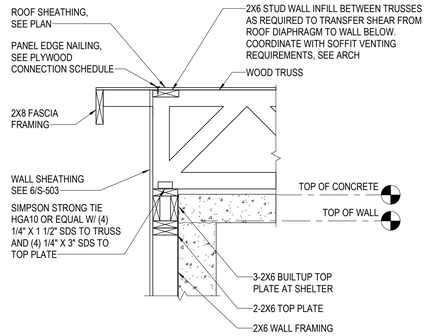
PLYWOOD CONNECTION SCHEDULE			
APPLICATION	THICKNESS	CONNECTION AT ALL SUPPORTED PANEL EDGES	CONNECTION AT INTERMEDIATE SUPPORTS
ROOF	1/2"	4" OC	12" OC
WALL	1/2"	4" OC	12" OC

NOTES:

1. ALL DIAPHRAGMS TO BE BLOCKED.
2. APPLIES EVERYWHERE UNO.
3. FASTENERS FOR ROOF TO BE TYPE 316 SS 10d COMMON NAILS WITH 1 1/2" MIN PENETRATION INTO FRAMING MEMBER OR BLOCKING.
4. FASTENERS FOR WALL TO BE TYPE 316 SS 10d COMMON NAILS WITH 1 1/2" MIN PENETRATION INTO FRAMING MEMBER OR BLOCKING.

6 PLYWOOD CONNECTION SCHEDULE

NOT TO SCALE



NOTES:

1. SOFFIT ASSEMBLY AND SHEATHING NOT SHOWN, SEE ARCH DRAWINGS.
2. SEE PLYWOOD CONNECTION SCHEDULE FOR FASTENING REQUIREMENTS.
3. COORDINATE FASTENER REQUIRED FOR ATTACHMENT OF SIMPSON CONNECTORS TO STRUCTURE TYP.

7 FRAMING CONNECTION AT WALL AT SHELTER

3/4" = 1'-0"

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ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
STRUCTURAL DETAILS

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE As indicated

SHEET S-503

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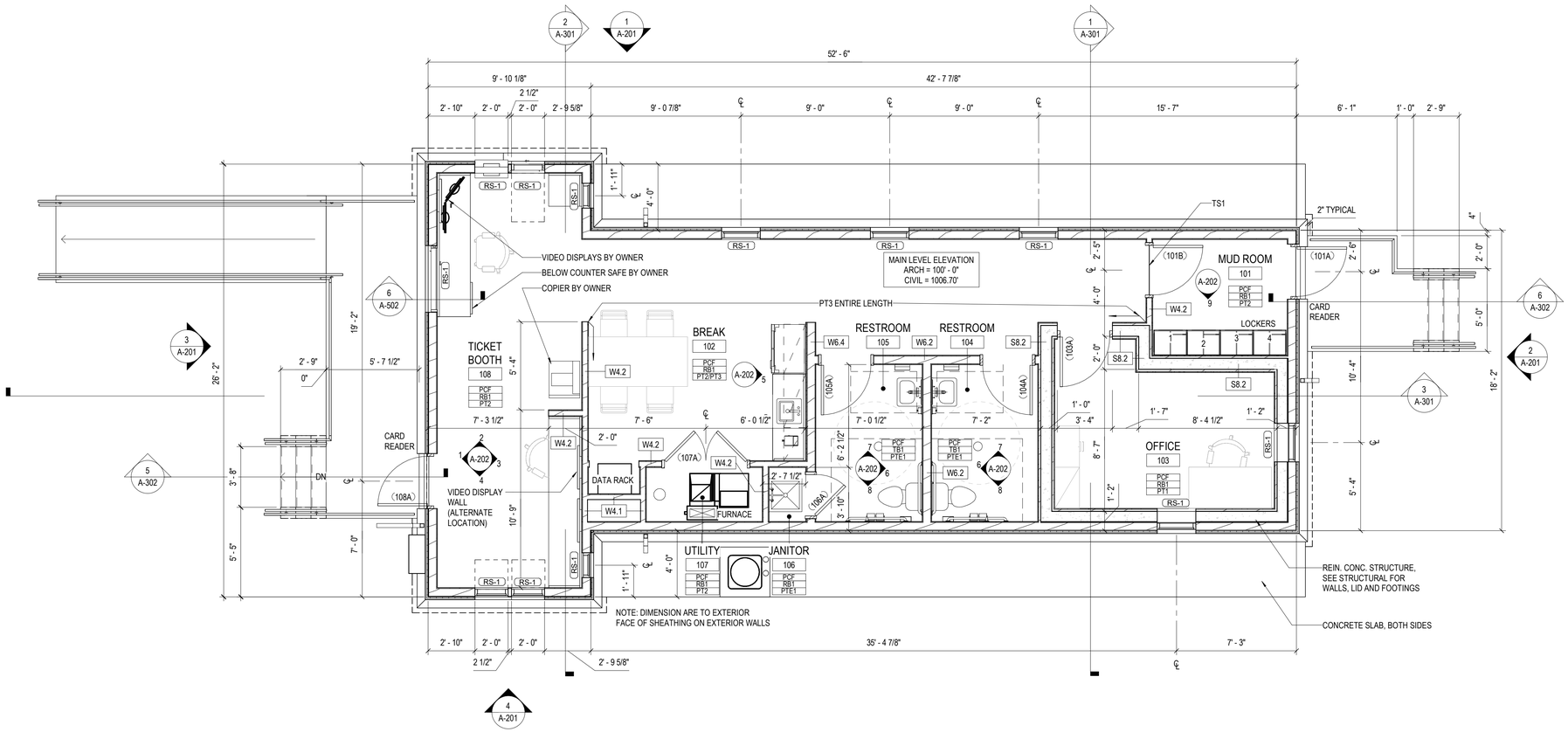

GENERAL NOTES

1. DRAWINGS & SPECIFICATIONS ARE COMPLIMENTARY COMPONENTS OF THE CONTRACT DOCUMENTS. REVIEW ALL DRAWINGS AND SPECIFICATIONS FOR THE COMPLETE SCOPE OF WORK. NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION IN INCONSISTENCIES, CONTRADICTIONS OR OMISSIONS ARE DISCOVERED.
2. DO NOT SCALE DRAWINGS, IF DIMENSIONAL INFORMATION IS REQUIRED & NOT FOUND, NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION.
3. ALL DIMENSIONS ARE ACTUAL AND TO FINISH FACE OF INTERIOR PARTITIONS OR FACE OF CONCRETE WALLS AND TO EXTERIOR FACE OF SHEATHING AT EXTERIOR WALLS, UNO.
4. ALL INTERIOR WALLS ARE AS TAGGED AND PER WALL TYPES DETAIL. REFER TO INTERIOR WALL PARTITION TYPE ASSEMBLIES LEGEND BELOW.
5. VERIFY MECHANICAL AND ELECTRICAL DRAWINGS FOR SCOPE AND INTERFACE. CONTACTOR SHALL COORDINATE LOCATION FOR ALL MECHANICAL AND ELECTRICAL ITEMS WITH GENERAL CONSTRUCTION. REVIEW ANY DISCREPANCIES WITH THE ENGINEER PRIOR TO INSTALLATION AND/OR FABRICATION.
6. IT IS THE INTENT OF THIS CONTRACT THAT ALL AREAS AFFECTED BY CONSTRUCTION BE FINISHED & COMPLETE PROJECT. CONTRACTOR SHALL PATCH, REPAIR & ADJUST AS REQUIRED TO ACHIEVE THIS FINISHED PROJECT.
7. REFER TO A-202 FOR TOILET ACCESSORY LEGEND.
8. REFER TO A-601 FOR DOOR AND WINDOW SCHEDULES/LEGENDS, AND DOOR AND WINDOW TYPES.
9. ALL STRUCTURAL STOOPS TO SLOPE AWAY FROM FACE OF BUILDING, SEE STRUCTURAL DRAWINGS.
10. PROVIDE SOUND ATTENTUATION INSULATION AT ALL WALLS & CEILINGS OF RESTROOMS AND UTILITY ROOM.

PARTITION TYPE ASSEMBLIES

W4.1	SINGLE LAYER 5/8" GWB ONE SIDE - 2x4 STUDS @ 16" O.C.
W4.2	SINGLE LAYER 5/8" GWB BOTH SIDES - 2x4 STUDS @ 16" O.C.
W6.2	SINGLE LAYER 5/8" GWB BOTH SIDES - 2x6 STUDS @ 16" O.C.
W6.4	SINGLE LAYER 5/8" GWB BOTH SIDES, PLYWOOD SHEATHING ONE SIDE - 2x6 STUDS @ 16" O.C.; SEE STRUCTURAL.
S8.1	8" REINFORCED CONCRETE WALL W/ FURRING ON ONE SIDE - SINGLE LAYER 5/8" GWB OVER 1 1/2" FURRING; SEE STRUCTURAL.
S8.2	8" REINFORCED CONCRETE WALL W/ FURRING ON BOTH SIDES - SINGLE LAYER 5/8" GWB OVER 1 1/2" FURRING; SEE STRUCTURAL.

FINISHES LEGEND

FLOOR — X
BASE TRIM — X
WALL — X

PCF	POLISHED CONCRETE
TB1	TILE COVE BASE
RB1	RESILIENT BASE
PT1	PAINT
PT2	PAINT
PT3	PAINT
PT4	PAINT
PTE1	EPOXY PAINT
PTE2	EPOXY PAINT
RS-1	MANUAL ROLLER SHADE

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MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

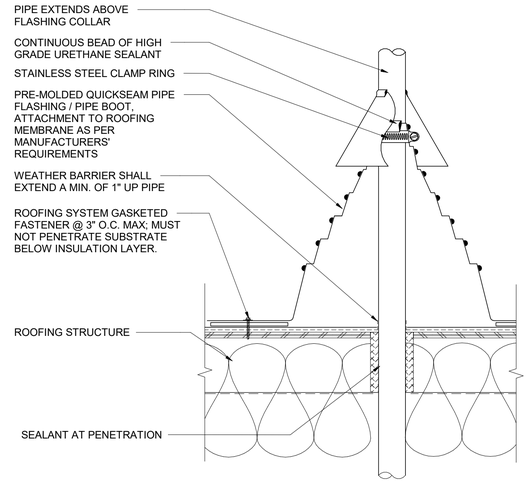
METRO PARK WEST SCALE HOUSE DESIGN

SCALE HOUSE ARCHITECTURE PLAN

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 1/4" = 1'-0"

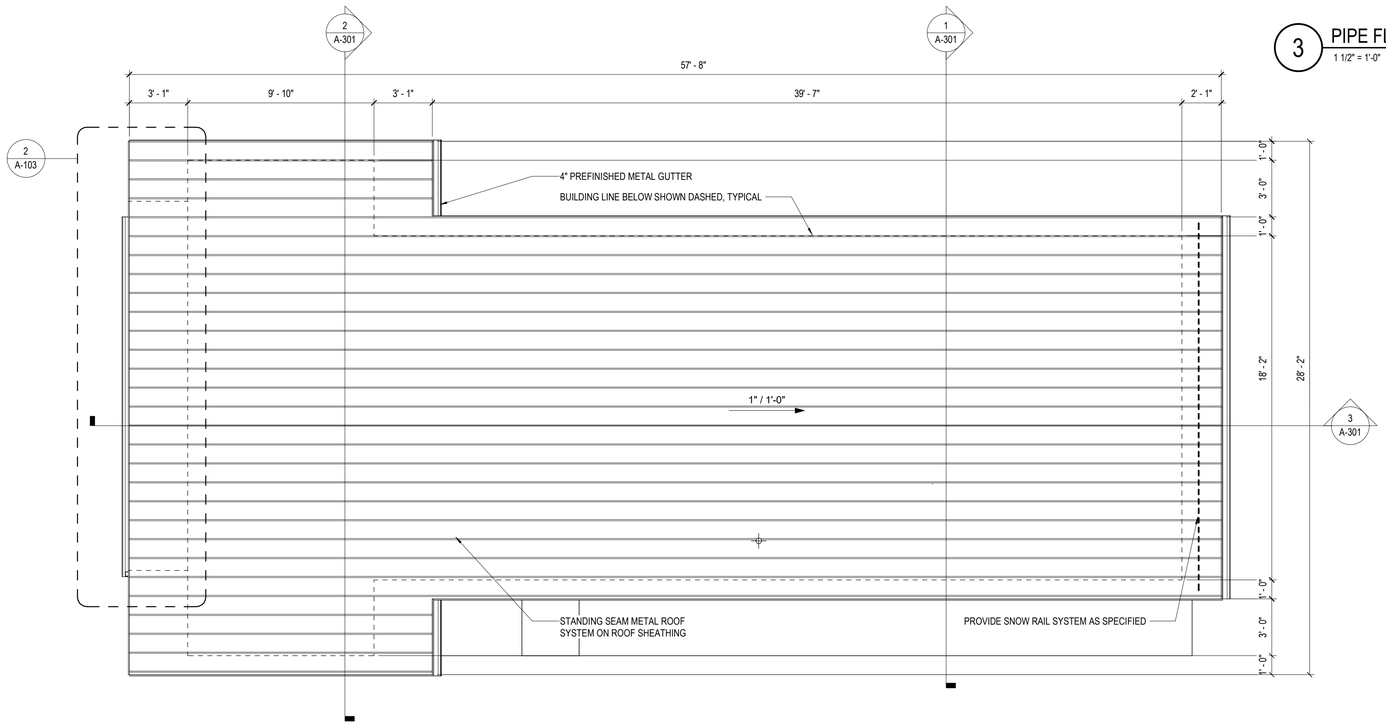
SHEET A-102



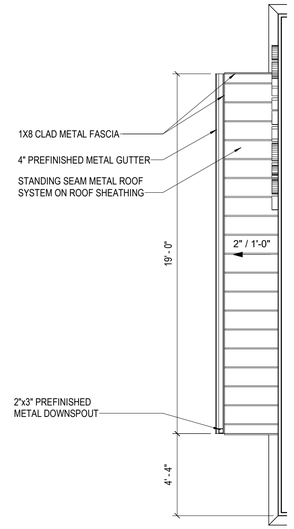
3 PIPE FLASHING @ ROOF
1 1/2" = 1'-0"

GENERAL NOTES

1. DRAWINGS & SPECIFICATIONS ARE COMPLIMENTARY COMPONENTS OF THE CONTRACT DOCUMENTS. REVIEW ALL DRAWINGS AND SPECIFICATIONS FOR THE COMPLETE SCOPE OF WORK. NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION IN INCONSISTENCIES, CONTRADICTIONS OR OMISSIONS ARE DISCOVERED.
2. DO NOT SCALE DRAWINGS, IF DIMENSIONAL INFORMATION IS REQUIRED & NOT FOUND, NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION.
3. ALL DIMENSIONS ARE ACTUAL AND TO FINISH FACE OF INTERIOR PARTITIONS OR FACE OF CONCRETE WALLS AND TO EXTERIOR FACE OF SHEATHING AT EXTERIOR WALLS, UNO.
4. ALL INTERIOR WALLS ARE AS TAGGED AND PER WALL TYPES DETAIL. REFER TO INTERIOR WALL PARTITION TYPE ASSEMBLIES LEGEND ON SHEET A-102.
5. VERIFY MECHANICAL AND ELECTRICAL DRAWINGS FOR SCOPE AND INTERFACE. CONTACTOR SHALL COORDINATE LOCATION FOR ALL MECHANICAL AND ELECTRICAL ITEMS WITH GENERAL CONSTRUCTION. REVIEW ANY DISCREPANCIES WITH THE ENGINEER PRIOR TO INSTALLATION AND/OR FABRICATION.
6. IT IS THE INTENT OF THIS CONTRACT THAT ALL AREAS AFFECTED BY CONSTRUCTION BE FINISHED & COMPLETE PROJECT. CONTRACTOR SHALL PATCH, REPAIR & ADJUST AS REQUIRED TO ACHIEVE THIS FINISHED PROJECT.
7. REFER TO A-202 FOR TOILET ACCESSORY LEGEND.
8. REFER TO A-601 FOR DOOR AND WINDOW SCHEDULES/LEGENDS, AND DOOR AND WINDOW TYPES.
9. ALL STRUCTURAL STOOPS TO SLOPE AWAY FROM FACE OF BUILDING, SEE STRUCTURAL DRAWINGS.
10. PROVIDE SOUND ATTENUATION INSULATION AT ALL WALLS & CEILINGS OF RESTROOMS AND UTILITY ROOM..



1 ROOF PLAN
1/4" = 1'-0"



2 CANOPY ROOF PLAN
1/4" = 1'-0"

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ARCHITECTURE ROOF PLAN

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE As indicated

SHEET A-103

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-SAF.rvt
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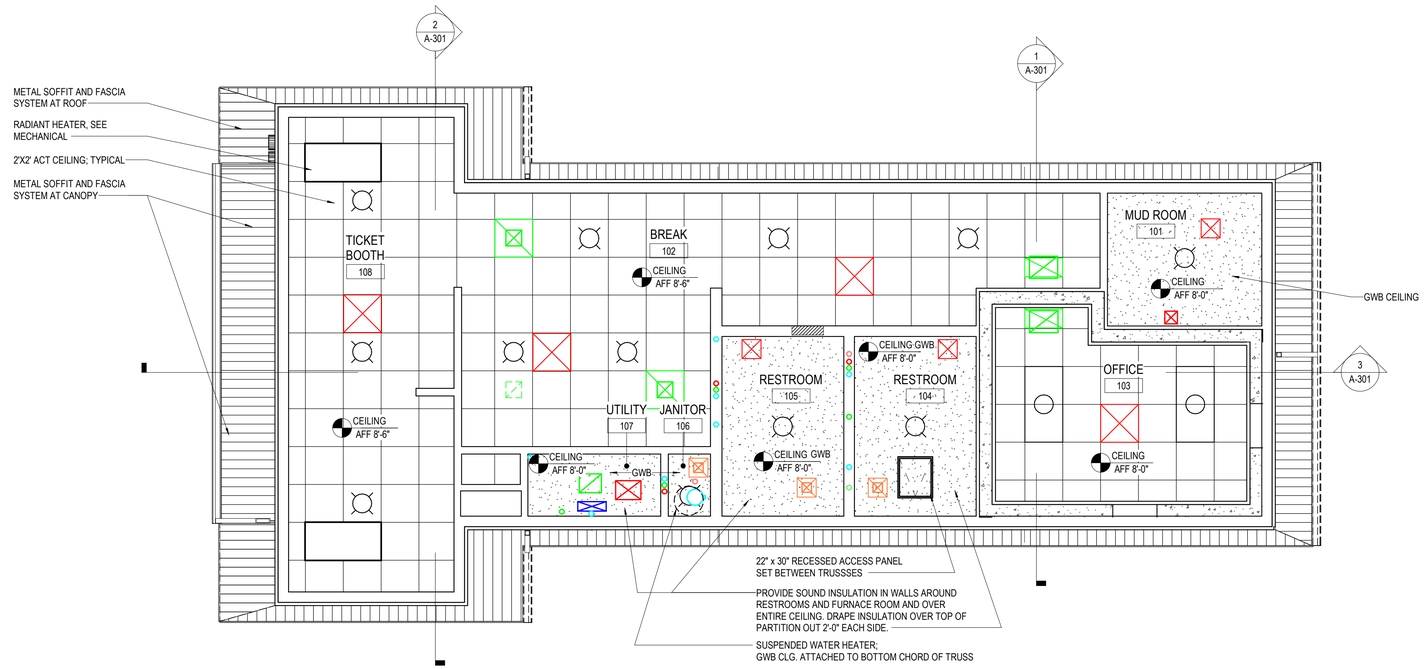
GENERAL NOTES

1. DRAWINGS & SPECIFICATIONS ARE COMPLIMENTARY COMPONENTS OF THE CONTRACT DOCUMENTS. REVIEW ALL DRAWINGS AND SPECIFICATIONS FOR THE COMPLETE SCOPE OF WORK. NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION IN INCONSISTENCIES, CONTRADICTIONS OR OMISSIONS ARE DISCOVERED.
2. DO NOT SCALE DRAWINGS, IF DIMENSIONAL INFORMATION IS REQUIRED & NOT FOUND, NOTIFY ARCHITECT IMMEDIATELY FOR CLARIFICATION.
3. ALL DIMENSIONS ARE ACTUAL AND TO FINISH FACE OF INTERIOR PARTITIONS OR FACE OF CONCRETE WALLS AND TO EXTERIOR FACE OF SHEATHING AT EXTERIOR WALLS, UNO.
4. ALL INTERIOR WALLS ARE AS TAGGED AND PER WALL TYPES DETAIL. REFER TO INTERIOR WALL PARTITION TYPE ASSEMBLIES ON SHEET A-102.
5. VERIFY MECHANICAL AND ELECTRICAL DRAWINGS FOR SCOPE AND INTERFACE. CONTACTOR SHALL COORDINATE LOCATION FOR ALL MECHANICAL AND ELECTRICAL ITEMS WITH GENERAL CONSTRUCTION. REVIEW ANY DISCREPANCIES WITH THE ENGINEER PRIOR TO INSTALLATION AND/OR FABRICATION.
6. IT IS THE INTENT OF THIS CONTRACT THAT ALL AREAS AFFECTED BY CONSTRUCTION BE FINISHED & COMPLETE PROJECT. CONTRACTOR SHALL PATCH, REPAIR & ADJUST AS REQUIRED TO ACHIEVE THIS FINISHED PROJECT.
7. REFER TO A-202 FOR TOILET ACCESSORY LEGEND.
8. REFER TO A-601 FOR DOOR AND WINDOW SCHEDULES/LEGENDS, AND DOOR AND WINDOW TYPES.
9. ALL STRUCTURAL STOOPS TO SLOPE AWAY FROM FACE OF BUILDING, SEE STRUCTURAL DRAWINGS.
10. PROVIDE SOUND ATTENUATION INSULATION AT ALL WALLS & CEILINGS OF RESTROOMS AND UTILITY ROOM.



ISSUE	DATE	DESCRIPTION
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PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
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ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

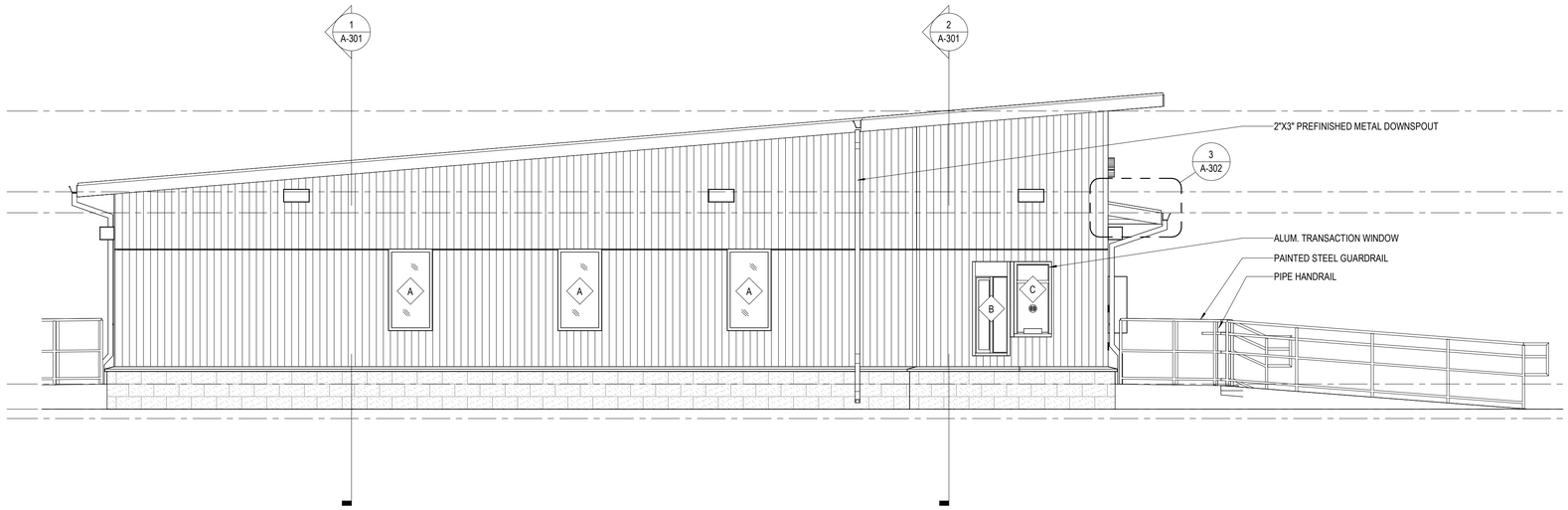
SCALE HOUSE
ARCHITECTURE REFLECTED CEILING PLAN

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 1/4" = 1'-0"

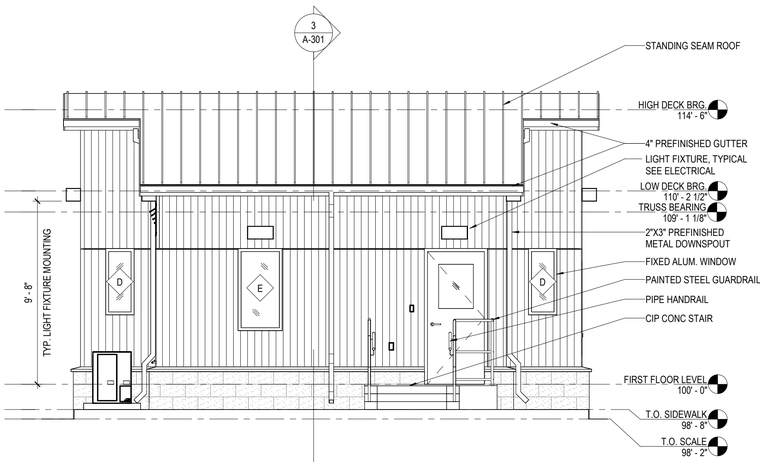
SHEET A-104

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-SAF.rvt
6/13/2024 4:58:36 PM



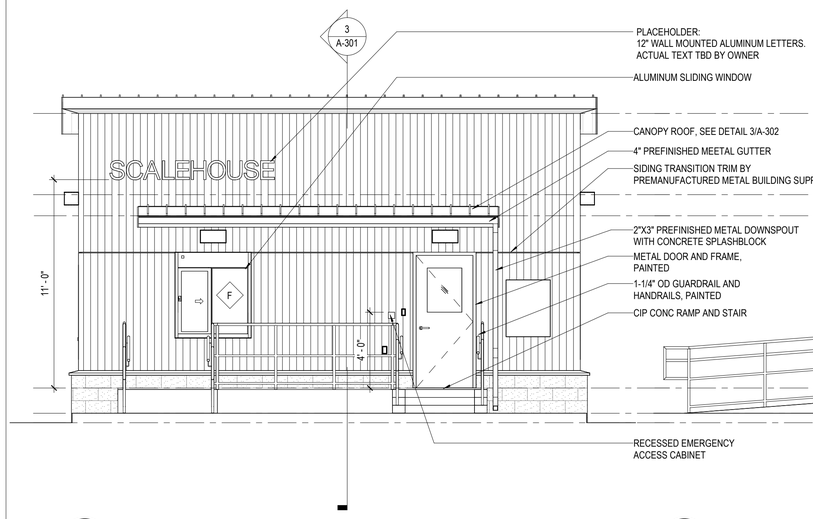
1 EAST ELEVATION

1/4" = 1'-0"



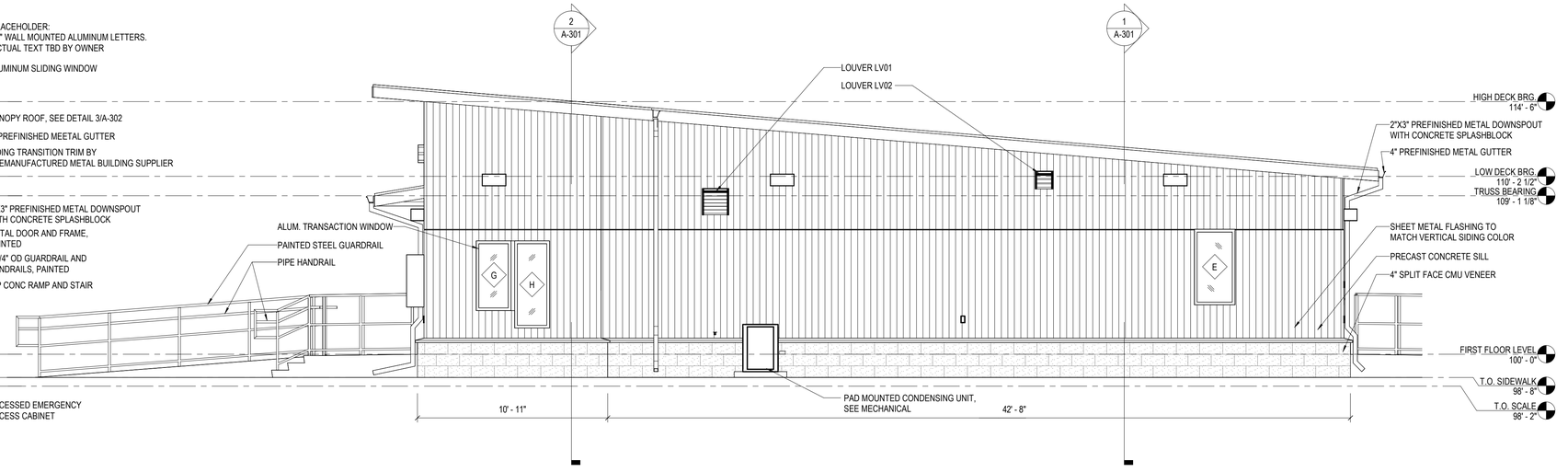
2 SOUTH ELEVATION

1/4" = 1'-0"



3 NORTH ELEVATION

1/4" = 1'-0"



4 WEST ELEVATION

1/4" = 1'-0"

B

A

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
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MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

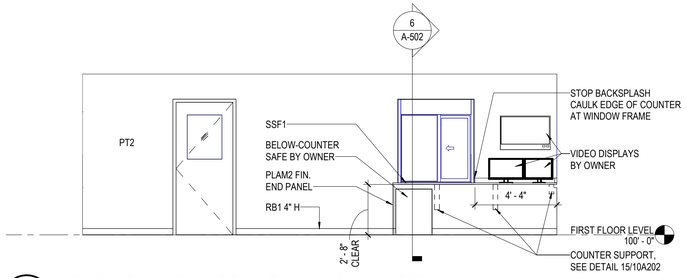
SCALE HOUSE
ARCHITECTURE EXTERIOR ELEVATIONS

0 1" 2"

FILENAME 10386668-SAF.rvt

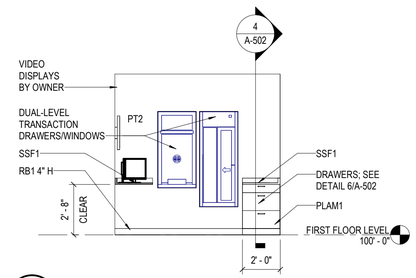
SCALE 1/4" = 1'-0"

SHEET A-201



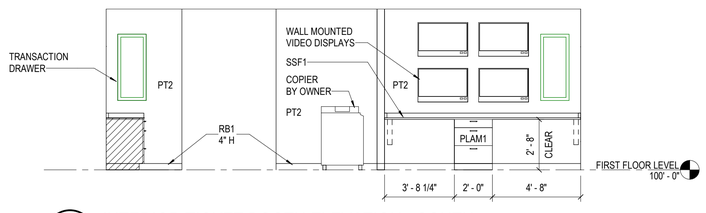
1 INTERIOR TICKET BOOTH ELEVATION - NORTH

1/4" = 1'-0"



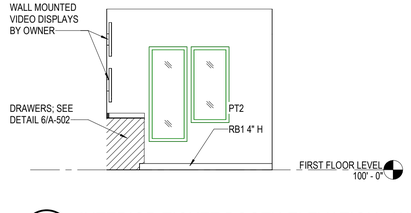
2 INTERIOR TICKET BOOTH ELEVATION - EAST

1/4" = 1'-0"



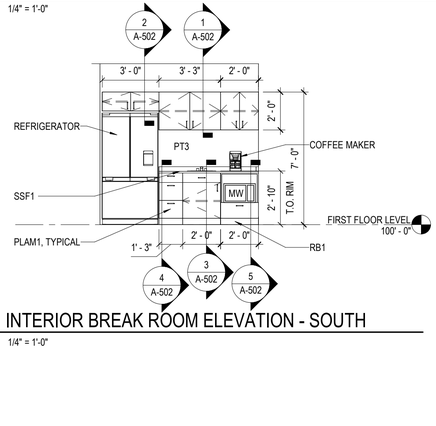
3 INTERIOR TICKET BOOTH ELEVATION - SOUTH

1/4" = 1'-0"



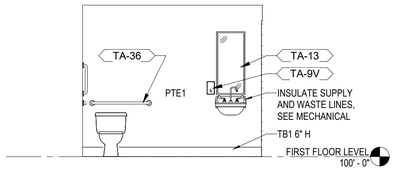
4 INTERIOR TICKET BOOTH ELEVATION - WEST

1/4" = 1'-0"



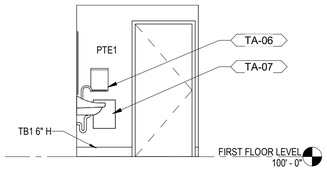
5 INTERIOR BREAK ROOM ELEVATION - SOUTH

1/4" = 1'-0"



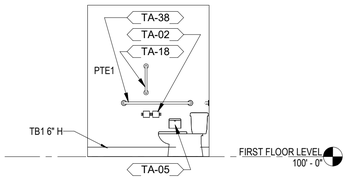
6 INTERIOR RESTROOM ELEVATION

1/4" = 1'-0"



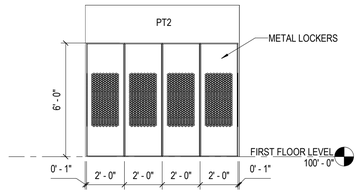
7 INTERIOR RESTROOM ELEVATION

1/4" = 1'-0"



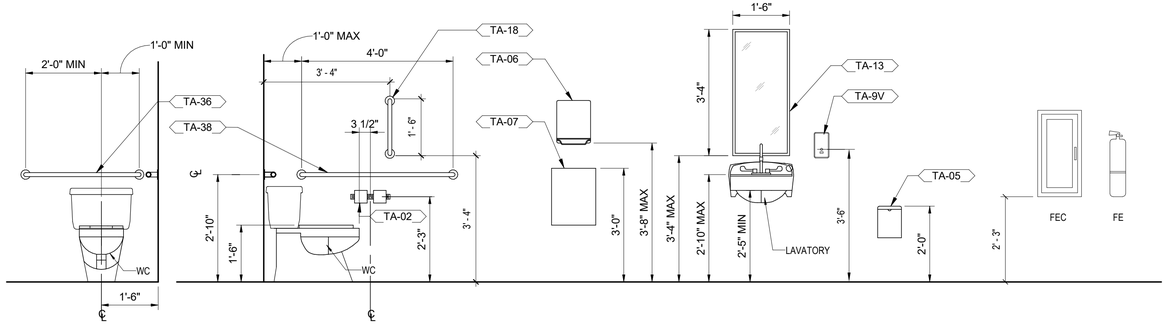
8 INTERIOR RESTROOM ELEVATION

1/4" = 1'-0"



9 INTERIOR MUD ROOM ELEVATION - WEST

1/4" = 1'-0"



TOILET ACCESSORY LEGEND:

TA-02:	TOILET TISSUE DISPENSER (DOUBLE NON-CONTROLLED)
TA-05:	FEMININE NAPKIN DISPOSAL
TA-06:	PAPER TOWEL DISPENSER
TA-07:	WASTE RECEPTACLE
TA-9V:	LIQUID SOAP DISPENSER
TA-13:	MIRROR SIZE INDICATED ON DRAWINGS.
TA-18:	GRAB BAR; 18"
TA-36:	GRAB BAR; 36"
TA-38:	GRAB BAR; 48"

13 TOILET ACCESSORY MOUNTING

1/2" = 1'-0"

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FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

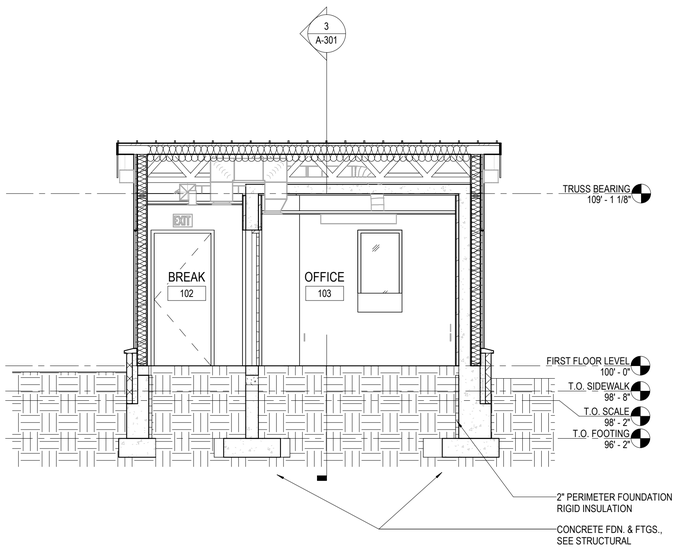
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ARCHITECTURE INTERIOR ELEVATIONS & SECTIONS

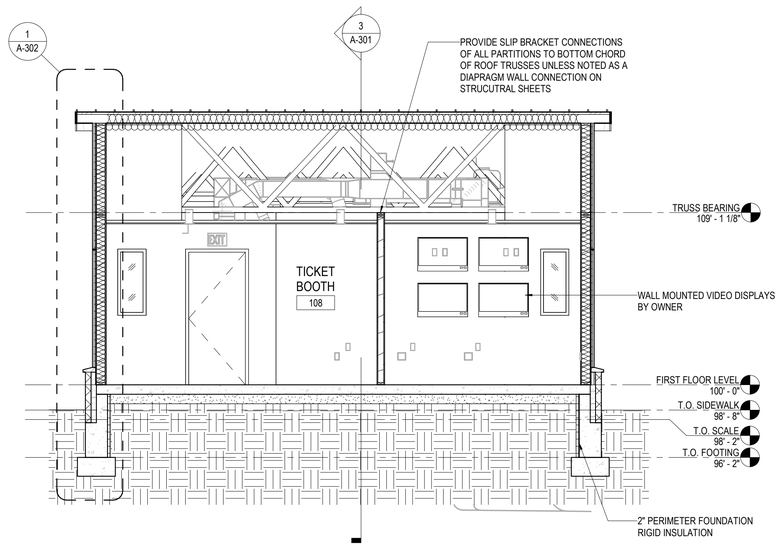
0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE As indicated

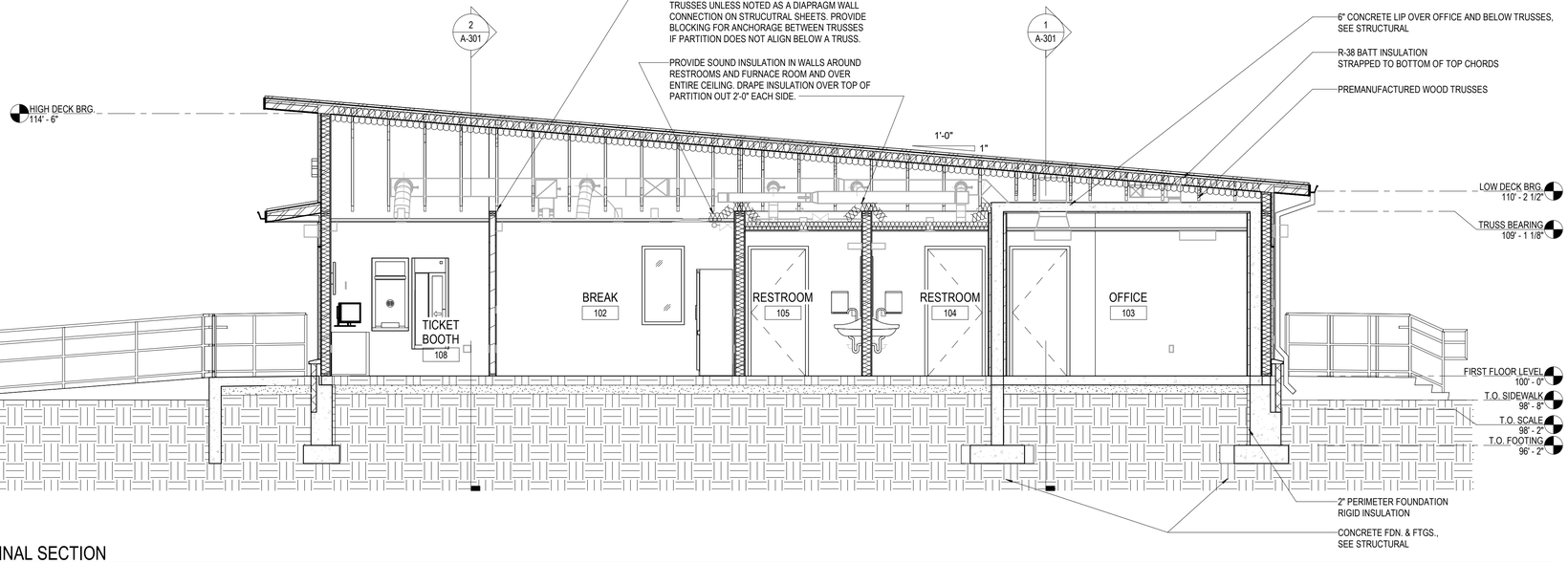
SHEET
A-202



1 CROSS SECTION
1/4" = 1'-0"



2 CROSS SECTION
1/4" = 1'-0"



3 LONGITUDINAL SECTION
1/4" = 1'-0"

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
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FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

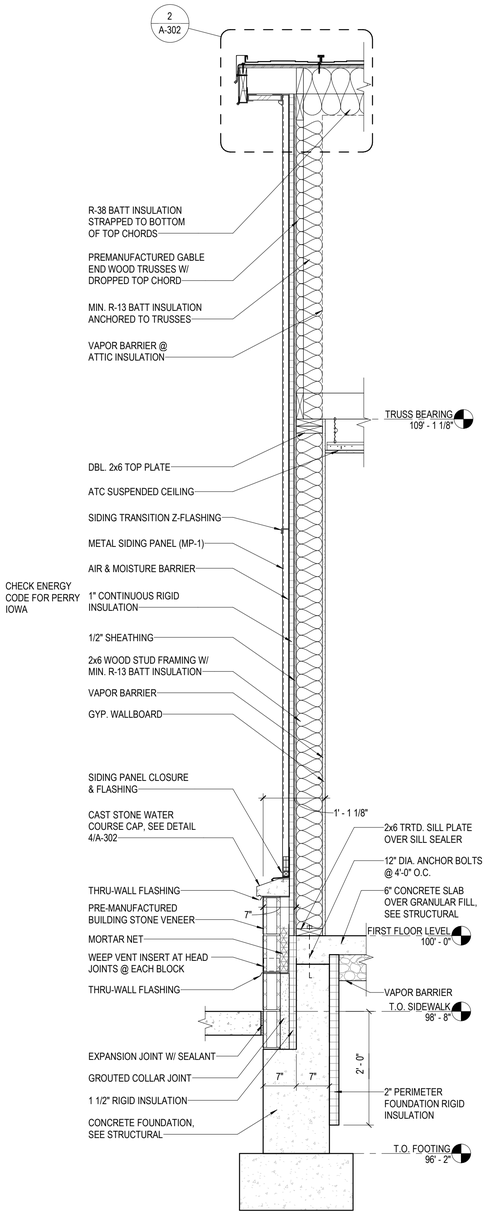
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ARCHITECTURE BUILDING SECTIONS

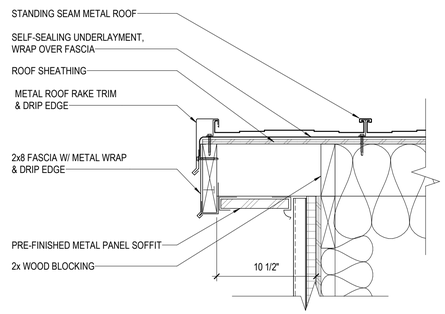
0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 1/4" = 1'-0"

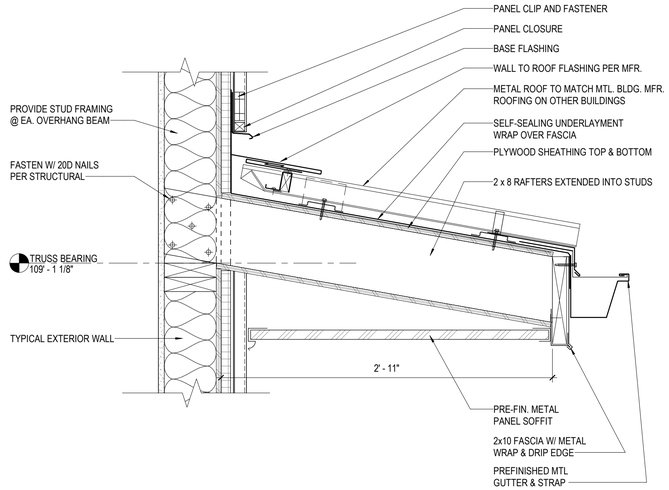
SHEET
A-301



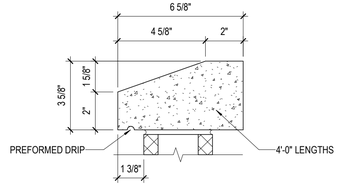
1 WALL SECTION
3/4" = 1'-0"



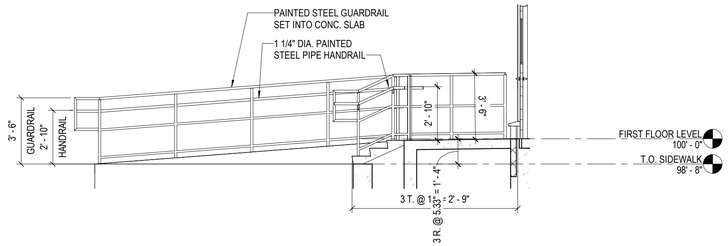
2 FASCIA/SOFFIT DETAIL
1 1/2" = 1'-0"



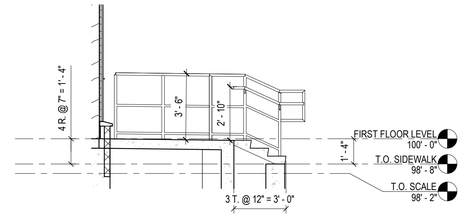
3 CANOPY ROOF
1 1/2" = 1'-0"



4 CAST STONE WATER COURSE CAP
3" = 1'-0"



5 STAIR & RAMP SECTION
1/4" = 1'-0"



6 STAIR SECTION
1/4" = 1'-0"

ISSUE	DATE	DESCRIPTION
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MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

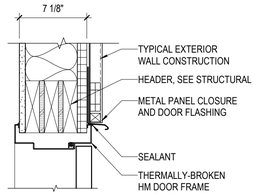
SCALE HOUSE
ARCHITECTURE WALL SECTIONS

0 1" 2"

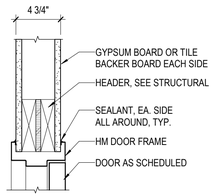
FILENAME 10386668-SAF.rvt
SCALE As indicated

SHEET
A-302

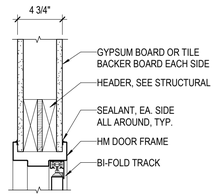
Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-SAF.rvt
6/13/2024 4:39:29 PM



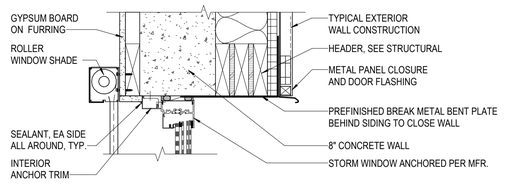
1 HM DOOR HEAD IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



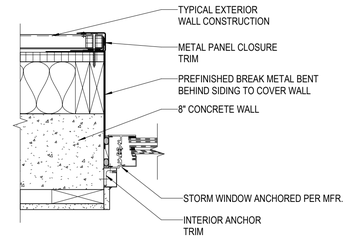
2 HM DOOR HEAD IN WOOD STUD WALL
1 1/2" = 1'-0"



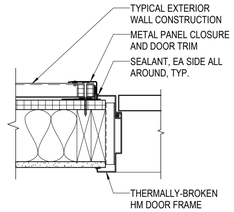
3 HM BI-FOLD DOOR HEAD IN WOOD STUD WALL
1 1/2" = 1'-0"



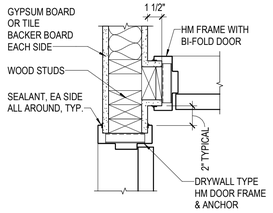
13 STORM WINDOW HEAD IN EXT. WALL
1 1/2" = 1'-0"



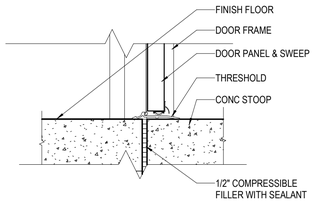
14 STORM WINDOW JAMB IN EXT. WALL
1 1/2" = 1'-0"



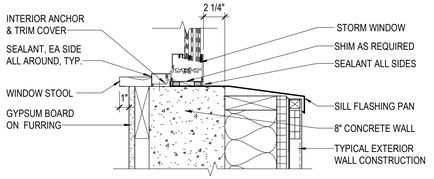
4 HM DOOR JAMB IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



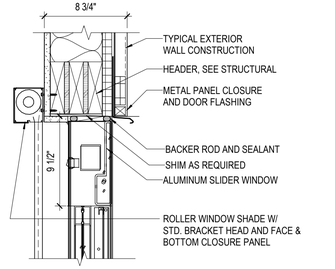
5 HM DOOR CORNER JAMB IN WOOD STUD WALL
1 1/2" = 1'-0"



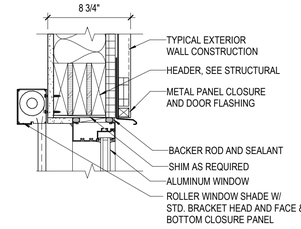
6 HM DOOR SILL
1 1/2" = 1'-0"



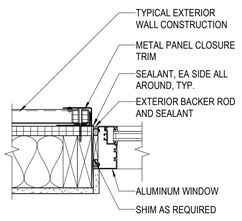
15 STORM WINDOW SILL IN EXT. WALL
1 1/2" = 1'-0"



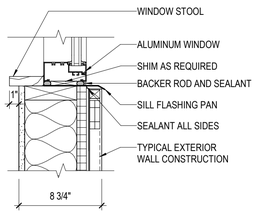
16 SLIDING WINDOW HEAD IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



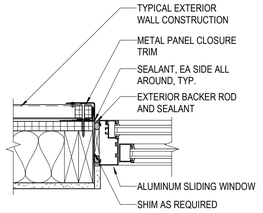
7 WINDOW HEAD IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



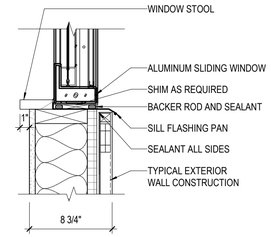
8 WINDOW JAMB IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



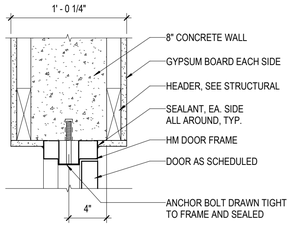
9 WINDOW SILL IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



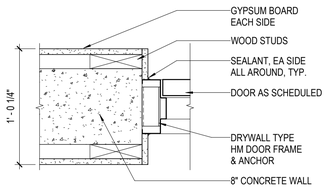
17 SLIDING WINDOW JAMB IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



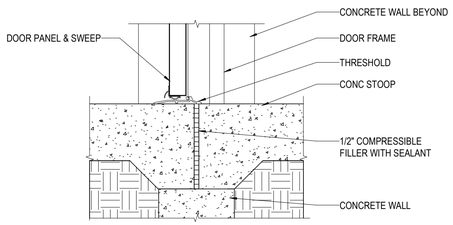
18 SLIDING WINDOW SILL IN EXT. WOOD STUD WALL
1 1/2" = 1'-0"



10 HM DOOR HEAD IN CONCRETE WALL
1 1/2" = 1'-0"



11 HM DOOR JAMB IN CONCRETE WALL
1 1/2" = 1'-0"



12 HM DOOR CONCRETE SILL
1 1/2" = 1'-0"

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ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE ARCHITECTURE DETAILS

0 1" 2"

FILENAME 10386668-SAF.rvt

SCALE 1 1/2" = 1'-0"

SHEET A-501

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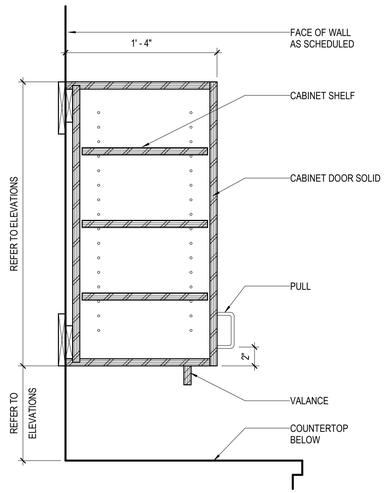
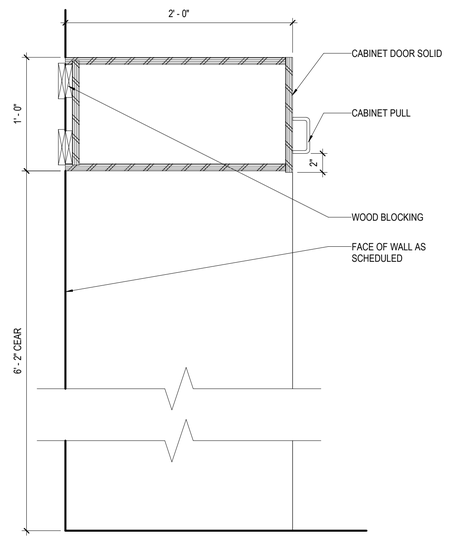
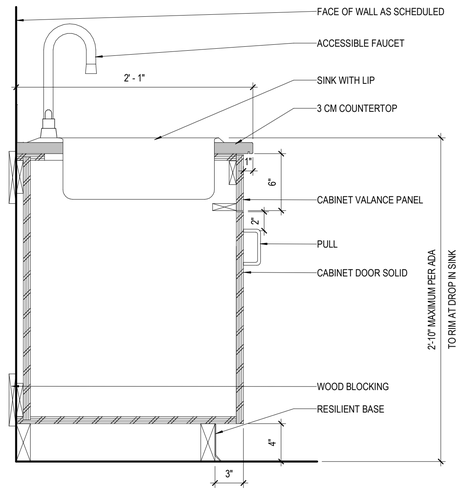


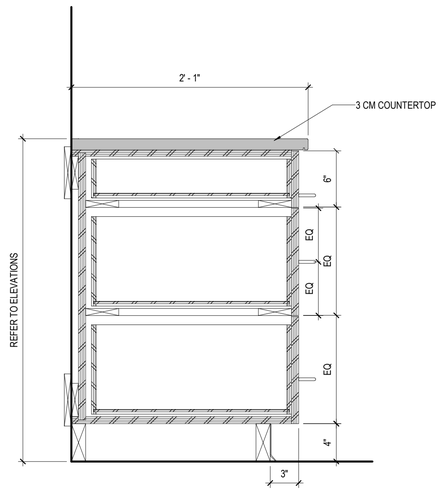
1 UPPER CABINET
1 1/2" = 1'-0"



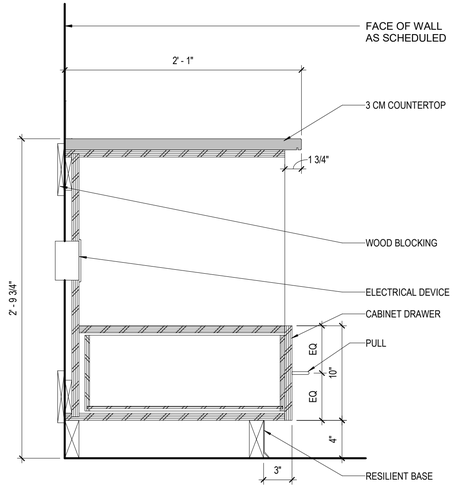
2 UPPER CABINET AT REFRIGERATOR
1 1/2" = 1'-0"



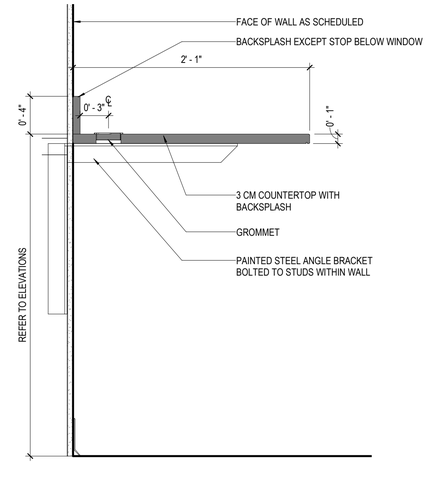
3 SINK BASE CABINET
1 1/2" = 1'-0"



4 BASE CABINET - 3 DRAWER
1 1/2" = 1'-0"



5 MICROWAVE BASE CABINET
1 1/2" = 1'-0"



6 SECTION DETAIL @ COUNTERTOP WITH CONCEALED BRACKET
1 1/2" = 1'-0"

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METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ARCHITECTURE DETAILS

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 1 1/2" = 1'-0"

SHEET
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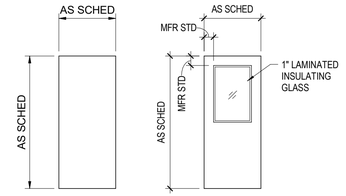
DOOR SCHEDULE

DOOR NUMBER		WIDTH	HEIGHT	DOOR TYPE	DOOR MATERIAL	DOOR FINISH	FRAME TYPE	FRAME MATERIAL	FRAME FINISH	RATING	HARDWARE SET	DETAILS HEAD	DETAILS JAMB	DETAILS SILL	*REMARKS
101A		3' - 0"	7' - 0"	HG	HM	PT	1	HM	PT	--	1.0	1/A-501	4/A-501	6/A-501	
101B		3' - 0"	7' - 0"	F	WD	FAS	1	HM	PT	--	6.0	2/A-501	5/A-501	-	
103A		3' - 0"	7' - 0"	F	HM	PT	1	HM	PT	--	2.0	10/A-501	11/A-501	12/A-501	
104A		3' - 0"	7' - 0"	F	WD	FAS	1	HM	PT	--	5.0	2/A-501	5/A-501	-	
105A		3' - 0"	7' - 0"	F	WD	FAS	1	HM	PT	--	5.0	2/A-501	5/A-501	-	
106A		2' - 6"	7' - 0"	F	WD	FAS	1	HM	PT	--	4.0	2/A-501	5/A-501	-	
107A	PR	2' - 6"	7' - 0"	F	WD	FAS	1	HM	PT	--	3.0	2/A-501	5/A-501	-	
108A		3' - 0"	7' - 0"	HG	HM	PT	1	HM	PT	--	1.0	1/A-501	4/A-501	6/A-501	

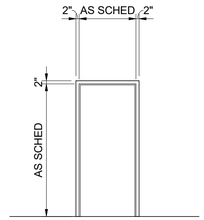
MATERIAL AND FINISH LEGEND

MATERIAL		FINISH	
HM	HOLLOW METAL	PT	PAINT
WD	WOOD	FAS	FACTORY APPLIED STAIN

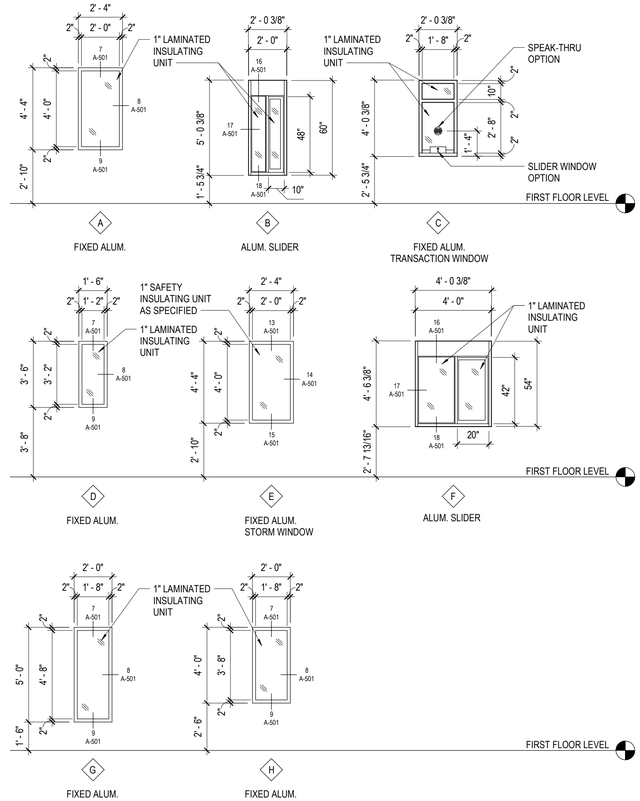
REMARKS:
1.



1 DOOR TYPES
1/4" = 1'-0"



2 DOOR FRAME TYPES
1/4" = 1'-0"



3 WINDOW TYPES
1/4" = 1'-0"

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Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ARCHITECTURE SCHEDULES

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE 1/4" = 1'-0"

SHEET
A-601

FINISH LEGEND

SPECIFICATION	CODE	DESCRIPTION	MFG	SERIES	COLOR	FINISH	SIZE	INSTALL METHOD	COMMENTS
POLISHED CONCRETE FINISHING									
03 35 43	PCF	POLISHED CONCRETE	SEE SPECIFICATIONS						-
ARCHITECTURAL CASEWORK									
06 41 00	PLAM1	PLASTIC LAMINATE	FORMICA	-	GRAYED OAK 5791-PG	PURE GRAIN	-	-	BREAK ROOM
TILE									
09 30 00	TB1	TILE COVE BASE	CROSSVILLE	GOTHAM, AV326.10612CBS	PAVEMENT	STANDARD	6" X 12", 3/8" THICKNESS	-	MAPEI COLOR 47 CHARCOAL GROUT
ACOUSTICAL CEILINGS (ACT)									
09 51 00	ACT1	ACOUSTICAL CEILING PANELS	ARMSTRONG	ULTIMA. 15/16 BEVELED TEGULAR, ITEM NO. 1911	WHITE	BEVELED TEGULAR	24" X 24" X 3/4" THICKNESS	USE WITH PRELUDE 15/16" GRID	MAIN CEILING TILE
09 51 00		GRID:	ARMSTRONG	15/16" PRELUDE XL	WHITE	---	---	---	---
RESILIENT BASE (RB)									
09 65 13	RB1	RESILIENT BASE	TARKETT	DURACOVE RUBBER	48 GREY	-	4 " HIGH	-	-
INTERIOR PAINTING									
09 91 23	PT1	PAINT	SHERWIN WILLIAMS	-	NEBULOUS WHITE SW7063	EGGSHELL	-	-	OFFICE WALL PAINT
09 91 23	PT2	PAINT	SHERWIN WILLIAMS	-	ARGOS SW7065	EGGSHELL	-	-	MAIN WALL PAINT
09 91 23	PT3	PAINT	SHERWIN WILLIAMS	-	GRIZZLE GRAY SW7068	EGGSHELL	-	-	ACCENT WALL PAINT
09 91 23	PT4	PAINT	SHERWIN WILLIAMS	-	GRIZZLE GRAY SW7068	SEMI-GLOSS	-	-	DOORS AND FRAMES
09 91 23	PTE1	EPOXY PAINT	SHERWIN WILLIAMS	-	ARGOS SW7065	EPOXY	-	-	RESTROOM WALLS
09 91 23	PTE2	EPOXY PAINT	SHERWIN WILLIAMS	-	CEILING BRIGHT WHITE SW7007	EPOXY	-	-	CEILING IN RESTROOMS
ROLLER WINDOW SHADES									
12 24 13	RS1	MANUAL ROLLER SHADE	SWF CONTRACT	R SERIES MANUAL SOLAR SHADE	CROSSHATCH R300, EBONY/STONE C8218	3% OPENNESS	SURFACE MOUNTED	-	USE AT ALL EXTERIOR WINDOWS UNLESS OTHERWISE NOTED
SOLID SURFACE FABRICATIONS									
12 36 63	SSF1	SOLID SURFACE	FORMICA	-	416 LUNA PEWTER	-	-	-	COUNTERTOPS/WORKSURFACES

INTERIOR FINISH ABBREVIATION SCHEDULE

FLOOR/BASE	
CFS	SEALED CONCRETE
CPT	CARPET TILE
EXIST	EXISTING
RT	RESILIENT TILE
TB	TILE BASE
RB	RESILIENT BASE
WCPT	WALK-OFF CARPET TILE
WALLS	
T	TILE
PT	PAINT
PTE	EPOXY PAINT
CELINGS	
ACT	ACOUSTICAL CEILING TILE
GWB	GYPSUM WALLBOARD
PT	PAINT
MISCELLANEOUS	
PLAM	PLASTIC LAMINATE
RS	ROLLER SHADE
SC	SHOWER CURTAIN
SSF	SOLID SURFACE FABRICATION
TS	TRANSITION STRIP

INTERIOR GENERAL NOTES

1. INTERIOR FINISH LEGEND IS FOR MATERIAL DESCRIPTION AND ASSIGNMENT ONLY:
   A. USE IN CONJUNCTION WITH THE ARCHITECTURAL SPECIFICATIONS AND DRAWINGS.
   B. BRING ANY APPARENT ERROR, INCONSISTENCY, OR OMISSION TO THE ATTENTION OF THE ARCHITECT BEFORE PROCEEDING.
   C. FIELD VERIFY EXISTING CONDITIONS OF SIMILAR ROOMS WHEN MATCHING FINISHES FOR THE SAME ROOM TYPE WITHIN THIS PROJECT.
2. GENERAL NOTES:
   A. AESTHETICS ARE A VERY IMPORTANT PART OF THIS PROJECT:
      1. ANY PROPOSED CHANGE IMPACTING APPEARANCE PRIOR TO THE BID REQUIRES SUBMITTAL OF ALTERNATE REQUESTS.
      2. ANY PROPOSED CHANGE IMPACTING APPEARANCE AFTER THE BID REQUIRES SUBMITTAL OF A SUBSTITUTION REQUEST.
   B. PROVIDE CONSISTENT MATERIAL COLORS AND PATTERNS IN EACH ROOM OR AREA. IF REQUIRED FOR CONSISTENCY, PROVIDE MATERIALS FRO...
3. TYPICAL FINISHES:
   A. SEE ROOM FINISH TAG ON DRAWINGS FOR FINISH INFORMATION.
      1. WHERE MULTIPLE FINISHES ARE LISTED ON ROOM FINISH TAG, REFER TO ADDITIONAL NOTES AND ELEVATIONS FOR LOCATION AND EXTENTS...
      2. ALIGN FINISHES IF THEY APPEAR TO ALIGN WITH A WALL CORNER, CASEWORK, OR OTHER BUILT COMPONENT.
      3. NOT ALL "ALIGNED" FINISHES ARE NOTED.
   B. HOLLOW METAL DOORS AND FRAMES SHALL BE PT6 UNLESS OTHERWISE NOTED.
   C. IN TOILET ROOMS WHERE WALL FINISH IS TILE, INSTALL TILE TO FLOOR AND CAULK SEAM. TILE BASE NOT REQUIRED.
4. PAINT:
   A. WHERE ITEMS OR SURFACES ARE NOT SPECIFICALLY MENTIONED, BRING TO THE ATTENTION OF ARCHITECT.
   B. GRILLS, DIFFUSERS, ELECTRICAL PANELS, ACCESS PANELS, ETC., WHICH ARE EXPOSED IN FINISH SPACES SHALL BE PAINTED TO MATCH ADJACEN...
      1. PAINT INTERIOR SURFACES OF DUCTS FLAT BLACK WHERE SURFACES ARE VISIBLE THROUGH GRILLS OR DIFFUSERS.
   C. UNLESS OTHERWISE INDICATED, METAL SURFACES OF ANODIZED ALUMINUM, STAINLESS STEEL, RHODIUM PLATED, COPPER, BRONZE AND SIMILAR FINISHED MATERIALS WILL NOT REQUIRE FINISH PAINTING.
   D. PAINT EXPOSED CONDUITS, SPRINKLER PIPING, PLUMBING PIPING, ETC. UNLESS NOTED OTHERWISE. THIS EXCLUDES MECH, ELEC, TELECOM, AND...
5. WALL FINISHES:
   A. ALL EXTERNAL CORNERS OF TILE WALLS SHALL RECEIVE METAL TRIM (TRIM1).
   B. URETHANE GROUT SHALL BE USED AT ALL FLOOR TILE LOCATIONS. SEE SPECIFICATION FOR FURTHER DETAILS.
6. FLOORING:
   A. WHERE CONTROL JOINTS PASS BEHIND RESILIENT OR OTHER WALL BASE, CAULK CONTROL JOINT USING A COLOR WHICH MATCHES THE COLOR ...
   B. WHERE FINISH FLOORING TERMINATES PROVIDE TRANSITION STRIPS AS SPECIFIED.
7. CEILING:
   A. SEE AC-SERIES DRAWINGS FOR CEILING LOCATIONS, LAYOUTS AND DETAILS.
      1. NOT ALL EXPOSED CEILINGS REQUIRE PAINTING. REFER TO AC-SERIES DRAWINGS FOR PT FINISH WHERE REQUIRED.
   B. WHERE ACCESS PANELS ARE REQUIRED, CONTRACTOR MUST VERIFY LOCATIONS WITH ARCHITECT PRIOR TO INSTALLATION.
8. CASEWORK:
   A. TYPICAL COUNTERTOP FINISH IS SSF1.
   B. WHERE WOOD GRAIN LAMINATE IS USED, GRAIN SHALL RUN VERTICALLY.
9. ROLLER SHADES:
   A. FIELD VERIFY ALL WIDTHS AND LENGTHS PRIOR TO SUBMITTALS AND ORDERING.
   B. REFER TO REFLECTED CEILING PLANS FOR LOCATIONS AND DETAILS FOR MOUNTING DETAILS.

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Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ARCHITECTURE INTERIOR FINISHES

0 1" 2"

FILENAME 10386668-SAF.rvt
SCALE

SHEET A-602

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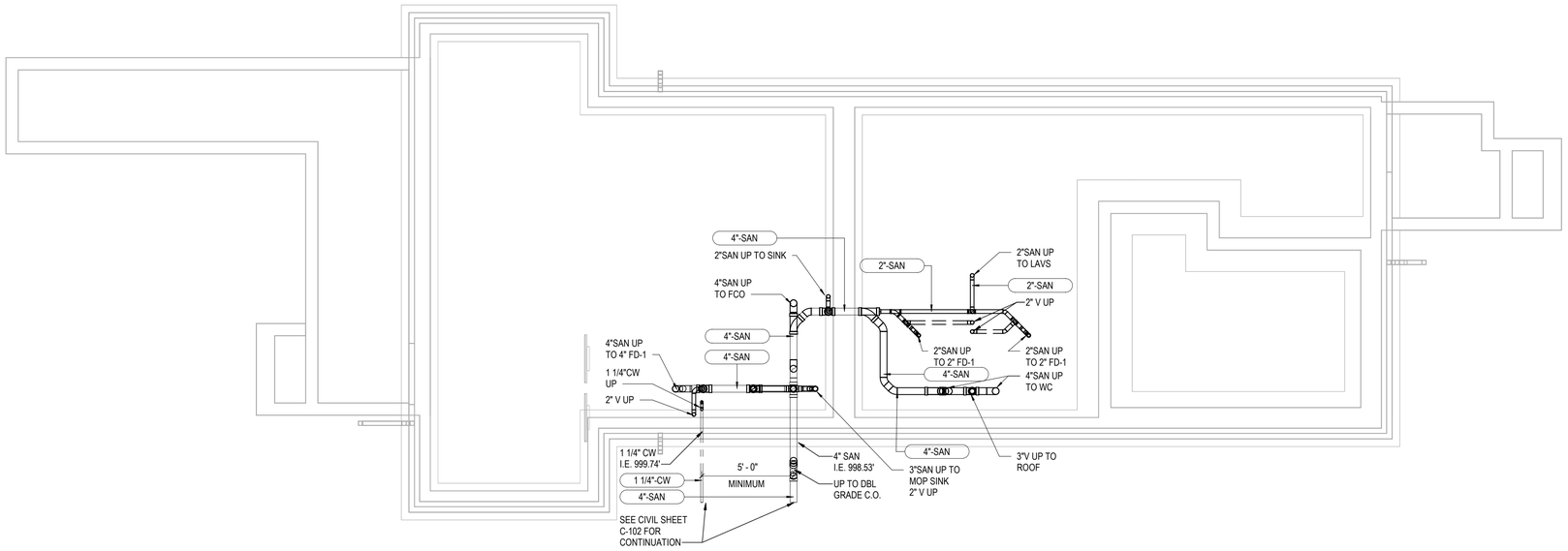
GENERAL NOTES

KEYNOTES



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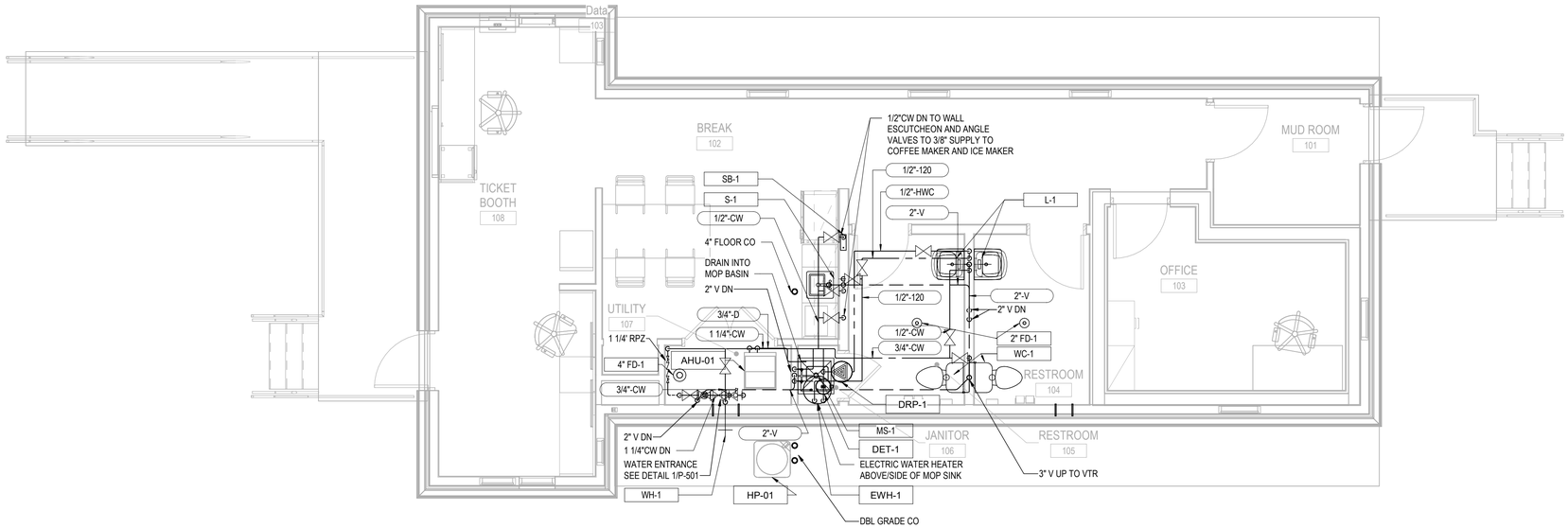
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE PLUMBING PLAN

0 1" 2"

FILENAME	10386668-MEP.rvt
SCALE	1/4" = 1'-0"

SHEET **P-100**



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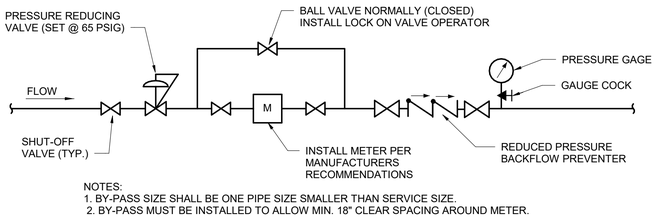
SCALE HOUSE PLUMBING PLAN

0 1" 2"

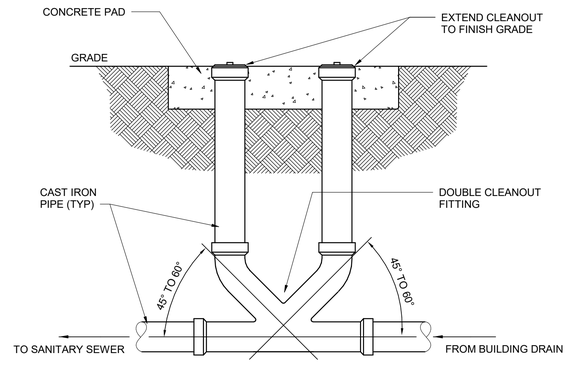
FILENAME 10386668-MEP.rvt
SCALE 1/4" = 1'-0"

SHEET P-101

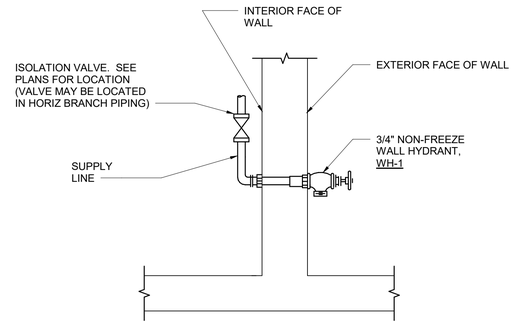


NOTES:
1. BY-PASS SIZE SHALL BE ONE PIPE SIZE SMALLER THAN SERVICE SIZE.
2. BY-PASS MUST BE INSTALLED TO ALLOW MIN. 18" CLEAR SPACING AROUND METER.

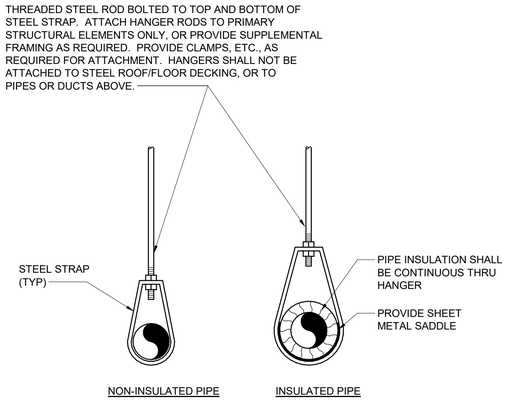
1 WATER SERVICE ENTRANCE DETAIL
NOT TO SCALE



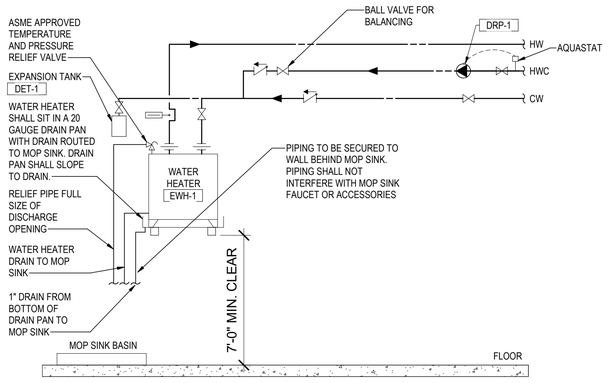
2 DOUBLE GRADE CLEANOUT DETAIL
NOT TO SCALE



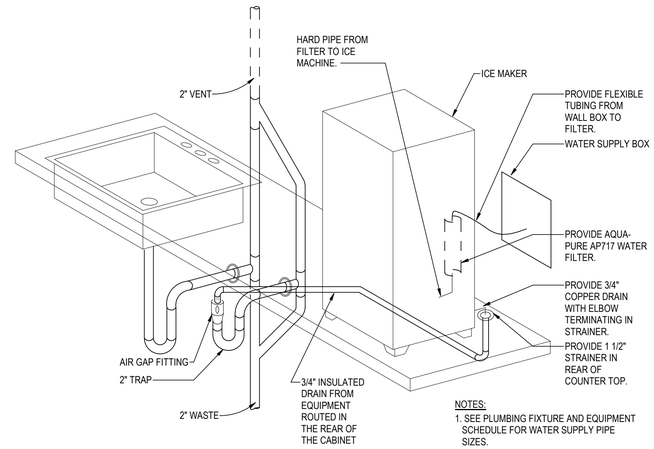
3 WALL HYDRANT INSTALLATION DETAIL
NOT TO SCALE



4 INDIVIDUAL PIPE HANGER DETAIL
NOT TO SCALE



5 WATER HEATER (EWH-1) DETAIL
NOT TO SCALE



NOTES:
1. SEE PLUMBING FIXTURE AND EQUIPMENT SCHEDULE FOR WATER SUPPLY PIPE SIZES.

6 ICE MACHINE CONNECTION DETAIL
NOT TO SCALE

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
CIVIL ENGINEER	KATIE KINLEY
STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
PLUMBING DETAILS

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE As indicated

SHEET P-501

WATER HEATER SCHEDULE

MARK NUMBER	LOCATION	CAPACITY			GAS HEATING DATA			MAX WATER PRESSURE (PSI)	STORAGE GALLON	ELECTRICAL DATA		FLUE SIZE (IN)	DIMENSIONS (IN) (LxWxH)	BASIS OF DESIGN	NOTE
		TEMP RISE (DEG F)	RECOVERY (GPH)	L W T (DEG F)	INPUT (MBH)	MAX INLET PRESSURE (IN. WG)	MANIFOLD PRESSURE (IN. WG)			(V/PH)	INPUT (kW)				
EWH-1	JAN (106)	80	31	140	---	---	---	150	10	240/1	6.0	---	28" X 18"	AO SMITH DSE-10A	1

NOTES:
1. UNIT TO BE MOUNTED ON WALL STAND ABOVE THE MOP SINK PER MANUFACTURER'S RECOMMENDATIONS.

EXPANSION TANK SCHEDULE

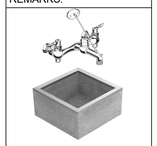
MARK NUMBER	LOCATION	SERVED	SYSTEM VOLUME GAL	TEMP RANGE DEG F		PRESS RANGE PSI		BLADDER PRESS PSI	TANK VOLUME GAL	ACCEPTANCE VOLUME GAL	TANK SIZE DIA x H IN	BASIS OF DESIGN	NOTE
				MAX	MIN	MAX	MIN						
DET-1	JAN (106)	EWH-1	10	140	60	150	15	55	2.0	1	8X14	AMTROL ST-5C-DD	1

NOTES:
TYP. EXPANSION TANKS SHALL BE ASME RATED.
TYP. RELIEF VALVE SETTINGS FOR SYSTEM TO BE SET AT MAXIMUM PRESSURE INDICATED IN SCHEDULE.
1. PROVIDE 150 PSIG MAXIMUM WORKING PRESSURE STEEL CONSTRUCTION.

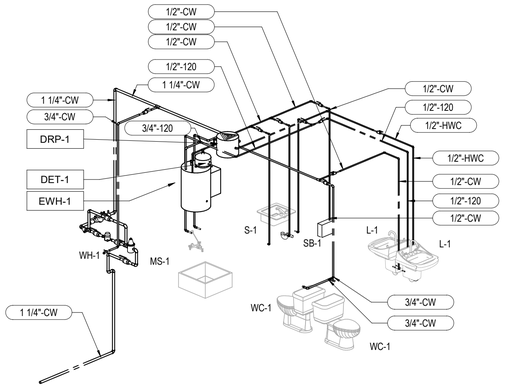
PUMP SCHEDULE

MARK NUMBER	LOCATION	SERVES	TYPE	FLOW GPM	HEAD FT WG	MIN EFF %	MOTOR DATA HP	AMP	V/PH	CONTROL TYPE	BASIS OF DESIGN	NOTE
DRP-1	JANITOR (106)	DOMESTIC HOT WATER RECIRC	WET ROTOR CIRCULATOR	1	10	18.1	1/6	1.02	115/1	ECM	B&G ECOCIRC+ 20-18	1,2,3

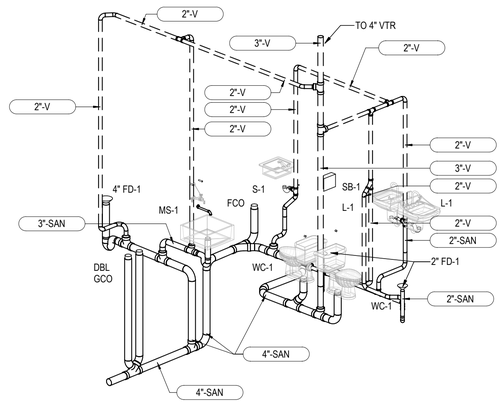
NOTES:
1. PROVIDE ISOLATION VALVE ON PUMP SUCTION; CHECK VALVE AND ISOLATION VAVLE ON PUMP DISCHARGE.
2. STAINLESS STEEL CONSTRUCTION, UNION FITTING.
3. EC MOTOR IS TO BE CONTROL BY CONSTANT SPEED BASED ON FLOWS SHOWN ABOVE.

L-1 LAVATORY	FIXTURE: WALL HUNG VITREOUS CHINA LAVATORY WITH FRONT OVERFLOW, SELF-DRAINING DECK AREA WITH BACK AND SIDE SPLASH SHIELDS AND FAUCET LEDGE. MOUNT AT ADA HEIGHT. OVERALL DIMENSIONS: 20-1/2"x18-1/4"x6-1/2" FAUCET: SINGLE LEVER, DECK MOUNTED WITH 4" FIXED CENTERS, RIGID CAST BRASS SPOUT, 4-5/8" CENTER-TO-CENTER, CHROME PLATED. 0.5 GPM NON-AERATING SPRAY. NOTE: INCLUDE ASSE 1070 MIXING VALVE AT FIXTURE.	FIXTURE: AMERICAN STANDARD "LUCERNE" 0355.012 FAUCET: CHICAGO FAUCET 420-E2805ABCP PIPE COVERS: TRUEBRO LAVGUARD2	WASTE: 2" VENT: 2" CW: 1/2" HW: 1/2" REMARKS:	
MS-1 MOP SINK	ONE PIECE PRECAST TERRAZZO MOP SERVICE BASIN WITH FACTORY INSTALLED DRAIN WITH COMBINATION DOME STRAINER AND LINT BASKET FOR 3" CAULK JOINT. STAINLESS STEEL CAPS ON CURBS. CAULK ALL EDGES WHERE BASIN MEETS WALL WITH COLOR MATCHED SILICONE SEALANT. SIZE: 24"X24"X12". FAUCET: EXPOSED WALL MOUNT-MOUNT UTILITY FAUCET WITH CAST BRASS BODY AND INTEGRAL SUPPLY STOPS. CAST BRASS SPOUT WITH BUCKET HOOK, TOP BRACE, VANDAL RESISTANT METAL LEVER HANDLES, VACUUM BREAKER, AND 1/4 TURN WASHERLESS CERAMIC DISC VALVE CARTRIDGES. CHROME PLATED FINISH NOTE: INCLUDE ASSE 1070 MIXING VALVE AT FIXTURE.	FIXTURE: FIAT TSB-100 FAUCET: AMERICAN STANDARD 8344.012 MOP HANGER BRACKET: FIAT #889-CC HOSE/BRACKET COMBO: FIAT #832-AA WALL GUARDS: FIAT #MSG 2424	WASTE: 3" VENT: 2" CW: 3/4" HW: 3/4" REMARKS:	
S-1 SINK	FIXTURE: SINGLE BOWL, SELF-RIMMING, COUNTER MOUNTED, 18 GAUGE TYPE 304 (18-8) STAINLESS STEEL WITH FAUCET LEDGE, SOUND DEADENING UNDERCOATING, PUNCHED TO MATCH FAUCET. DRAIN: CRUMB CUP STRAINER. OVERALL DIMENSIONS 22"x19-1/2"x7-5/8" DEEP. FAUCET: BELOW DECK MOUNTED SINK FAUCET WITH 8" FIXED CENTERS, CHROME PLATED FINISH. RESTRICTED SWING GOOSENECK SPOUT, 8" CENTER-TO-CENTER.4" BLADE HANDLES WITH COLOR INDEX BUTTONS. CERAMIC 1/4 TURN CARTRIDGE, 1/2" SUPPLY INLETS AND COUPLING NUT. 1.5 GPM AERATOR. NOTE: INCLUDE ASSE 1070 MIXING VALVE AT FIXTURE.	FIXTURE: ELKAY LR2219 FAUCET: CHICAGO FAUCET 786-GR8E35V317XKAB	WASTE: 2" VENT: 2" CW: 1/2" HW: 1/2" REMARKS:	
SB-1 SUPPLY BOX	FIXTURE: RECESSED, POWDER COAT WHITE. 7"X7"X2", QTR TURN. POWDER COATED STEEL CONSTRUCTION. WATER HAMMER ARRESTER VALVE.	FIXTURE: GUY GRAY MIB1AB	WASTE: - VENT: - CW: 1/2" HW: - REMARKS:	

WC-1 WATER CLOSET	FIXTURE: ADA COMPLIANT, FLOOR SET, VITREOUS CHINA HIGH EFFICIENT WATER CLOSET WITH COLOR MATCHED BOWL CAPS, 3" FLUSH VALVE, 2-1/8" TRAPWAY, 16-1/2" RIM HEIGHT, 10" ROUGH-IN, AND CHROME FINISH TRIP LEVER. COLOR: WHITE. 1.6 GALLONS PER FLUSH. SEAT: MOLDED PLASTIC, ELONGATED, SELF SUSTAINING CHECK HINGES, OPEN FRONT WITH COVER. COLOR: WHITE.	FIXTURE: AMERICAN STANDARD "CADET" 270AB.101 SEAT: AMERICAN STANDARD 5321.110	WASTE: 4" VENT: 2" CW: 1/2" HW: REMARKS:	
WH-1 WALL HYDRANT	AUTOMATIC DRAINING, FREEZELESS WALL HYDRANT WITH HOSE CONNECTION BACKFLOW PROTECTION. HYDRANT WILL DRAIN AS HANDLE IS SHUT-OFF, EVEN IF HOSE IS ATTACHED. 3/4" MALE HOSE THREAD, TWO INDEPENDENT CHECK VALVES. HARDENED STAINLESS STEEL OPERATING STEM AND ONE-PIECE VALVE PLUNGER TO CONTROL BOTH FLOW AND DRAIN FUNCTIONS. FINISH: CHROME PLATED. PROVIDE LOOSE TEE KEY.	FIXTURE: WOODFORD MODEL 67	WASTE: - VENT: - CW: 3/4" HW: - REMARKS:	
FD-1 FLOOR DRAIN	DRAIN: CAST IRON FLOOR DRAIN BODY WITH ANCHOR FLANGE, REVERSIBLE CLAMPING COLLAR, SEEPAGE OPENINGS, 1/2" PRIMER TAP WITH PLUG, AND ADJUSTABLE 5" ROUND SATIN FINISH NICKEL BRONZE TOP.	FIXTURE: WADE 1100-1-A5	WASTE: - VENT: - CW: - HW: - REMARKS:	



1 DOMESTIC WATER RISER DIAGRAM
NOT TO SCALE



2 WASTE AND VENT RISER DIAGRAM
NOT TO SCALE

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A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
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MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
PLUMBING SCHEDULES AND DIAGRAMS

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE 12" = 1'-0"

SHEET P-601

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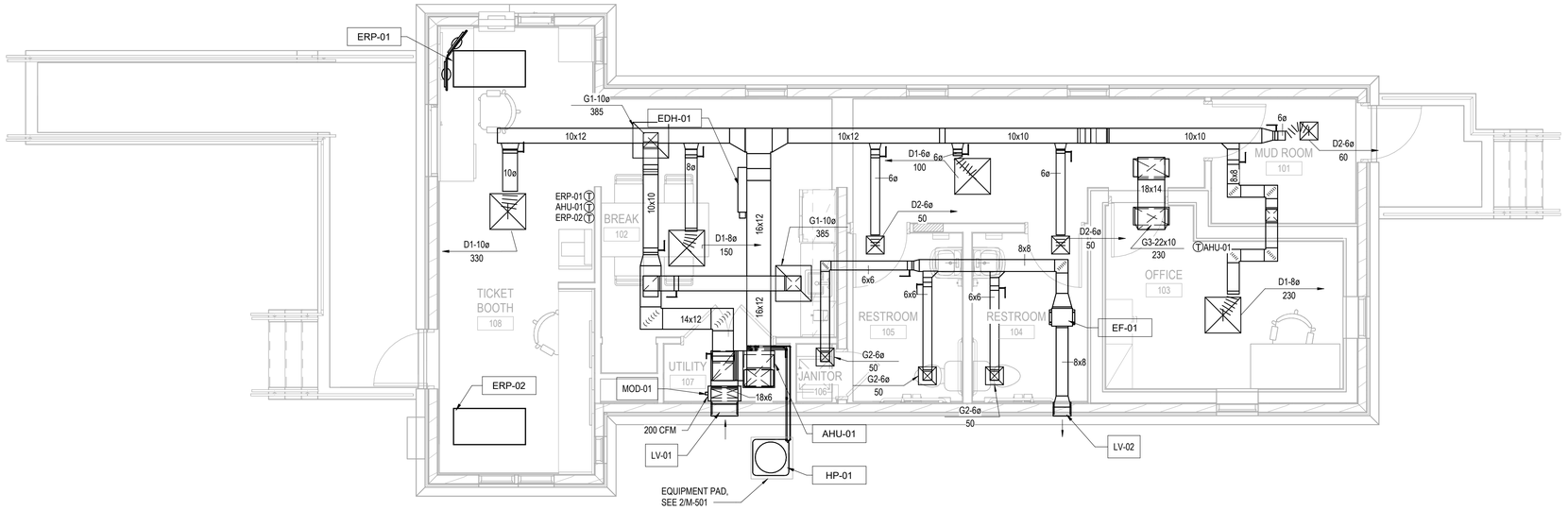

GENERAL NOTES

1. FOR SUPPLY AND RETURN DUCTWORK INTO OFFICE SPACE 103, DUCT SHALL BE CONSTRUCTED OF 12 GAUGE SHEET METAL WITH WELDED CONNECTION AT CONCRETE WALL.
2. AHU-01 THERMOSTATS IN TICKET BOOTH ROOM 108 AND OFFICE ROOM 103 SHALL BOTH BE AVERAGING THERMOSTATS FOR CONTROL OF AHU-01.

KEYNOTES (##)

SEQUENCE OF OPERATIONS:

AIR HANDLING UNIT WITH ELECTRIC DUCT HEATER AND CONDENSING UNIT (AHU-01, EDH-01, HP-01):

OCCUPIED: FAN SHALL RUN CONTINUOUSLY. OUTSIDE AIR DAMPER, MOD-01, SHALL BE OPEN.

OCCUPIED COOLING: ON A CALL FOR COOLING AHU-01 AND HP-01 SHALL OPERATE TO MAINTAIN SPACE COOLING SETPOINT OF 74°F (ADJUSTABLE). WHEN SPACE TEMPERATURE IS SATISFIED, HP-01 SHALL CYCLE OFF.

OCCUPIED HEATING: ON A CALL FOR HEATING AHU-01 AND HP-01 SHALL OPERATE TO MAINTAIN SPACE HEATING SETPOINT OF 60°F (ADJUSTABLE). IF HP-01 IS NOT ABLE TO MAINTAIN SPACE TEMPERATURE, ELECTRIC DUCT HEATER, EDH-01, SHALL OPERATE TO MAINTAIN SPACE TEMPERATURE. WHEN SPACE TEMPERATURE IS SATISFIED, EDH-01 AND HP-01 SHALL CYCLE OFF.

UNOCCUPIED: FAN SHALL CYCLE OFF UNTIL THERE IS A CALL FOR COOLING OR HEATING. OUTSIDE AIR DAMPER, MOD-01, SHALL REMAIN CLOSED.

UNOCCUPIED COOLING: AHU-01 AND HP-01 SHALL OPERATE TO MAINTAIN COOLING SETPOINT. UNITS SHALL CYCLE OFF WHEN SPACE TEMPERATURE IS SATISFIED.

UNOCCUPIED HEATING: AHU-01, HP-01, AND EDH-01 OPERATE AS DESCRIBED IN OCCUPIED MODE. UNITS SHALL CYCLE OFF WHEN SPACE TEMPERATURE IS SATISFIED.

EXHAUST FAN (EF-01):
FAN SHALL RUN CONTINUOUSLY DURING OCCUPIED HOURS AND SHALL CYCLE OFF DURING UNOCCUPIED HOURS.

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MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

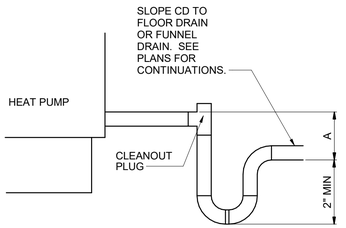
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE HVAC PLAN

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE 1/4" = 1'-0"

SHEET M-101

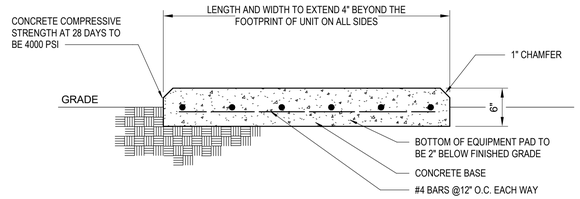


NOTES:

1. ON DRAW-THRU UNITS, THE (A) DIMENSION (IN INCHES) SHALL BE 1.5 TIMES THE AIR HANDLING UNIT'S SUCTION PRESSURE AT OPERATING CONDITIONS, BUT IN NO CASE LESS THAN 2-INCHES.

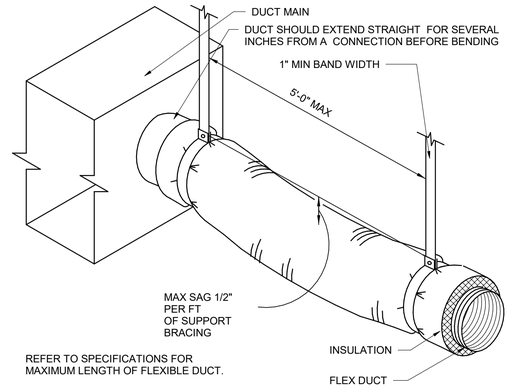
1 CONDENSATE DRAIN TRAP DETAIL

NOT TO SCALE



2 EXTERIOR CONCRETE EQUIPMENT PAD DETAIL

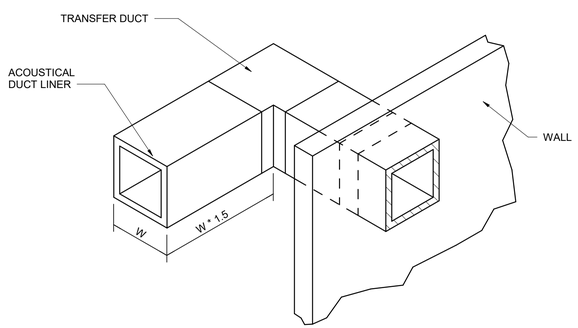
12" = 1'-0"



REFER TO SPECIFICATIONS FOR MAXIMUM LENGTH OF FLEXIBLE DUCT.

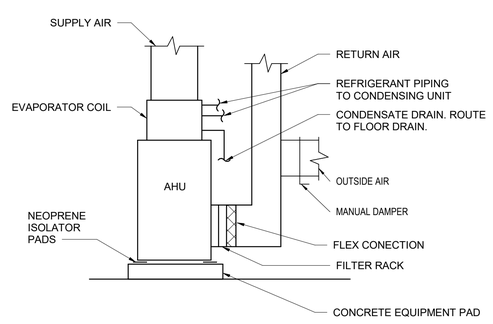
3 FLEXIBLE DUCT SUPPORT DETAIL

12" = 1'-0"



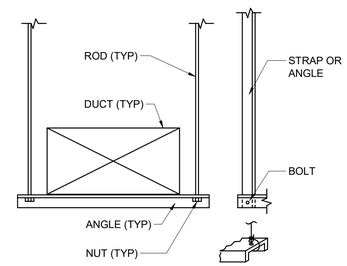
4 TRANSFER DUCT DETAIL

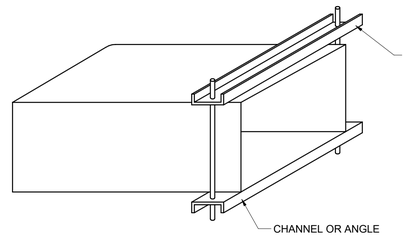
12" = 1'-0"



5 AHU DETAIL

NOT TO SCALE





LONG FLAT SPANS ON OVAL DUCT HAVE A TENDENCY TO SAG. OVAL DUCT WITH A MAJOR AXIS OF 42 INCHES OR MORE SHALL BE REINFORCED PER SMACNA HVAC DUCT CONSTRUCTION STANDARDS TYPE 2.

NOTES:

1. DO NOT EXCEED ALLOWABLE LOAD LIMITS OF ANY OR ALL OF THE INDIVIDUAL TRAPEZE PARTS.
2. DO NOT PENETRATE DUCT OR DUCT INSULATION VAPOR BARRIER WHEN SECURING HANGERS TO DUCTWORK. EVENTUALLY THE PENETRATIONS WILL LEAK.
3. USE HANGER CLAMPS OR BANDS FOR ROUND DUCT AS ROUND DUCT TENDS TO DEFORM ON TRAPEZE HANGERS.
4. TEARS, PUNCTURES, ETC. SHALL BE REPAIRED WITH TAPE OR MASTIC TO MAINTAIN THE INTEGRITY OF THE VAPOR BARRIER.
5. DO NOT USE ANY STRAP HANGERS WITH SCREWS ON ANY DUCTWORK THAT IS EXTERNALLY WRAPPED.

6 DUCT HANGING DETAIL

NOT TO SCALE

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PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
HVAC DETAILS

0 1" 2"

FILENAME	10386668-MEP.rvt
SCALE	NOT TO SCALE

SHEET M-501

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DIFFUSER, REGISTER AND GRILLE SCHEDULE

MARK	DESCRIPTION	MOUNTING	USE	FACE SIZE (IN)	NECK SIZE (IN)	MATERIAL	FINISH	MAX. N.C. AT P.D. SHOWN	ACCESSORIES	BASIS OF DESIGN	NOTES
D1	SQUARE, LOUVER FACE	LAY-IN	SUPPLY AIR	24X24	SEE PLAN	ALUMINUM	WHITE	30	--	TITUS TMS	
D2	SQUARE, LOUVER FACE	SURFACE MOUNT	SUPPLY AIR	12X12	SEE PLAN	ALUMINUM	WHITE	30	--	TITUS TMS	
G1	EGG-CRATE	LAY-IN	RET/EXH AIR	24X24	SEE PLAN	ALUMINUM	WHITE	30	--	TITUS 50F	1, 2
G2	EGG-CRATE	SURFACE MOUNT	RET/EXH AIR	12X12	SEE PLAN	ALUMINUM	WHITE	30	--	TITUS 50F	1, 2
G3	EGG-CRATE	LAY-IN	RET/EXH AIR	24X12	SEE PLAN	ALUMINUM	WHITE	30	--	TITUS 50F	1, 2

NOTES:
1. GRILLE SIZE SHALL BE 2" LARGER THAN NECK SIZE IN EACH DIMENSION (1" BORDER).
2. PROVIDE WITH INTEGRAL OPPOSED BLADE DAMPER (OBD) WHERE NO BALANCING DAMPER IS INDICATED IN BRANCH DUCT.

LOUVER SCHEDULE

MARK	LOCATION	SERVICE	SIZE (IN.)		CFM	MATERIAL	FINISH	FREE AREA (SQ FT)	VELOCIY (FPM)	MAX S.P. (IN. WG)	BASIS OF DESIGN	NOTES
			WIDTH	HEIGHT								
LV-01	UTILITY RM 107	INTAKE	18	18	200	ALUMINUM	PVDF	0.97	205	0.01	RUSKIN ELF 375 DX	1
LV-02	RESTROOM RM 104	EXHAUST	12	12	150	ALUMINUM	PVDF	0.34	445	0.04	RUSKIN ELF 375 DX	1

NOTES:
1. PROVIDE ALUMINUM BIRD SCREEN.

ELECTRIC DUCT HEATER UNIT SCHEDULE

MARK	LOCATION	CAP. (KW)	MIN. VEL. (FPM)	MOUNTING	DUCT SIZE (IN.)	VOLT	PH	HZ	AMPS	BASIS OF DESIGN	NOTES
EDH-01	BREAK ROOM	15	525	DUCT	16 X 12	240	1	60	62.5	INDEECO QUA	1, 2, 3

NOTES:
1. PROVIDE 4-20mA INPUT FOR SCR CONTROL.
2. PROVIDE WITH MANUFACTURER PROVIDED CONTROLLER.
3. PROVIDE DISCONNECT SWITCH. COORDINATE INSTALLATION WITH ELECTRICAL CONTRACTOR.

AIR TO AIR HEAT PUMP CONDENSING UNIT SCHEDULE

MARK	SERVES	REFR. TYPE	COOLING DATA		HEATING DATA		ELECTRICAL DATA				BASIS OF DESIGN	NOTES
			AMB. TEMP. (°F)	TOTAL CAP. (MBH)	AMB. TEMP. (°F)	TOTAL CAP. (MBH)	VOLT	PH	MCA (AMPS)	MOCP (AMPS)		
HP-01	AHU-01	R-410A	95.0	33.4	17.0	33.8	240	1	21.0	30.0	LENNOX EL18XPV-036-230	1, 2

NOTES:
1. PAIR WITH AHU-01 AND WIRED 7-DAY PROGRAMMABLE THERMOSTAT
2. PROVIDE UNIT WITH VARIABLE SPEED COMPRESSOR.

ELECTRIC AIR HANDLING HEAT PUMP

MARK	LOCATION	TOTAL CFM	MIN. OUTSIDE AIR (CFM)	EXT. STATIC PRESSURE	COOLING COIL DATA							HEATING DATA				ELECTRICAL DATA					BASIS OF DESIGN	NOTES
					E.A.T. (DB)	E.A.T. (WB)	L.A.T. DB (°F)	L.A.T. WB (°F)	TOTAL (MBH)	SENSIBLE (MBH)	SEER	FUEL TYPE	OUTPUT HIGH (MBH)	OUTPUT LOW (MBH)	HSPF	HP	VOLT	PH	FLA	MCA		
AHU-01	UTILITY RM	970	200	0.50	80.1	67.0	56.9	56.6	33	24.8	18.0	ELECTRIC	33.8	21.0	9.6	0.50	240	1	4.1	5.2	LENNOX CBA27UHE-036	1, 2, 3

NOTES:
1. PROVIDE FILTER AND FILTER RACK
2. PAIR WITH WIRED 7-DAY PROGRAMMABLE THERMOSTAT
3. PROVIDE UNIT WITH VARIABLE SPEED COMPRESSOR.

ELECTRIC RADIANT CEILING PANEL SCHEDULE

MARK	LOCATION	WATTS	PANEL DATA			ELECTRICAL DATA				BASIS OF DESIGN	NOTES
			LENGTH (INCHES)	WIDTH (INCHES)	WEIGHT (LBS)	VOLT	PH	HZ	AMPS		
ERP-01	TICKET BOOTH	725	48	24	30	240	1	60	3.0	INDEECO AS2448-725-240	1, 2, 3
ERP-02	TICKET BOOTH	725	48	24	30	240	1	60	3.0	INDEECO AS2448-725-240	1, 2

NOTES:
1. PROVIDE WALL MOUNTED THERMOSTAT.
2. PROVIDE WITH MANUFACTURER'S RECESSED GRID CEILING MOUNT KIT.

FAN SCHEDULE

MARK	SERVES	FAN DATA					ELECTRICAL DATA					WEIGHT (LBS)	BASIS OF DESIGN	NOTES
		TYPE	CFM	EXT. S.P. (IN. WG)	DRIVE	RPM	HP	VOLT	PH	HZ	FLA			
EF-01	RESTROOMS	INLINE	150	0.33	DIRECT	1,030	0.04	120	1	60	1.5	24	GREENHECK CSP-A390-VG	1

NOTES:
1. PROVIDE HIGH EFFICIENCY MOTOR WITH INTEGRAL ELECTRONICALLY COMMUTATED MOTOR (ECM).

DAMPER SCHEDULE

MARK	SERVES	SERVICE TYPE	BLADE TYPE	NOM. SIZE L x W (IN.)	BASIS OF DESIGN	NOTES
MOD-1	AHU-01	INTAKE	PARALLEL	18 X 6	RUSKIN CD-50	

NOTES:

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STRUCTURAL ENGINEER	CALEB ALLERHEILIGEN
ELECTRICAL ENGINEER	KEVIN VANDER KOLK
FIRE PROTECTION ENGINEER	ZACH SACHSENMAIER
MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

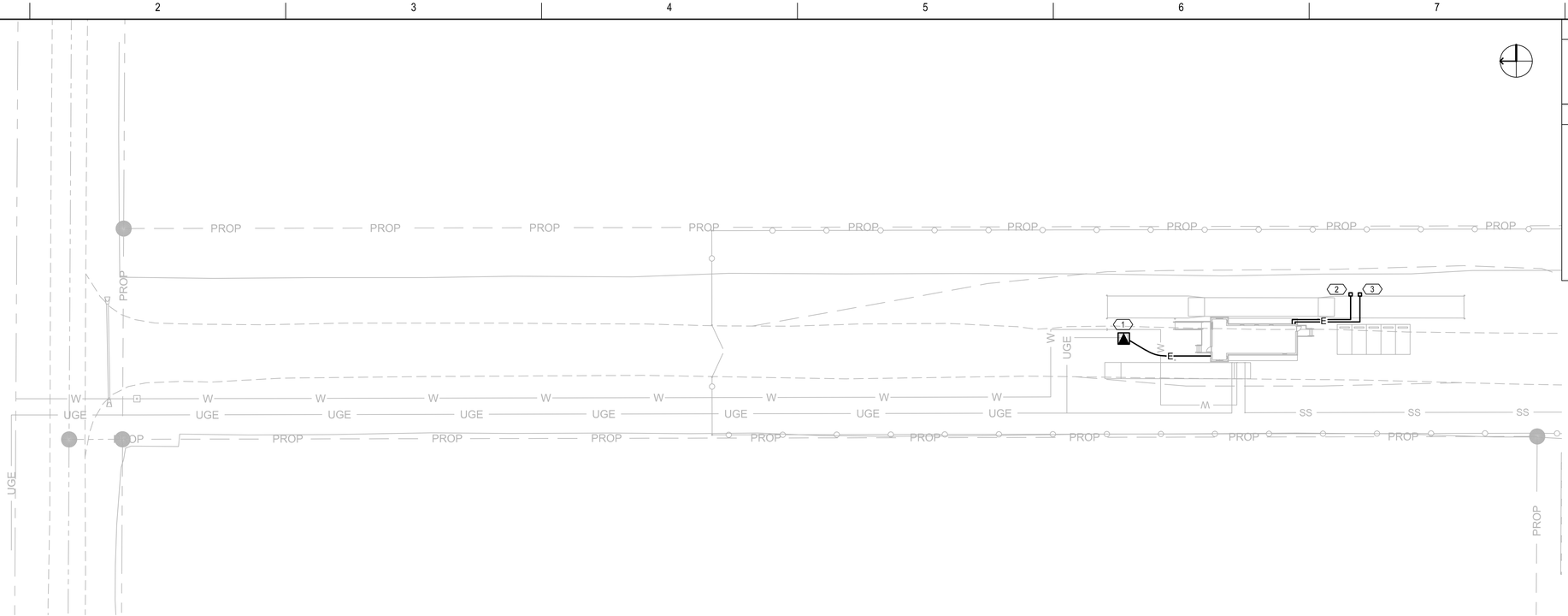
Metro Waste Authority
METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
HVAC SCHEDULES

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE

SHEET
M-601



GENERAL NOTES

1. PLACEHOLDER.

KEYNOTES (##)

1. UTILITY COMPANY WILL PROVIDE CONDUIT AND CONDUCTORS FOR PRIMARY CONNECTION TO UTILITY TRANSFORMER. REFER TO RISER DIAGRAM FOR SECONDARY CONDUIT AND CONDUCTOR INFORMATION.
2. PROVIDE HEAVY DUTY TRAFFIC RATED HANDHOLE AND TWO 1" CONDUITS WITH PULL WIRE FROM DATA CABINET TERMINATED IN THE HANDHOLE. PROVIDE COVER FOR HANDHOLE LABELED COMMUNICATIONS.
3. PROVIDE HEAVY DUTY TRAFFIC RATED HANDHOLE AND ONE 1" CONDUIT WITH PULL WIRE FROM PANEL 10-MP TERMINATED IN THE HANDHOLE. PROVIDE COVER FOR HANDHOLE LABELED POWER.

ISSUE	DATE	DESCRIPTION
A	06/14/2024	ISSUED FOR BID

PROJECT MANAGER	KATIE KINLEY
ARCHITECT	RANDALL MILBRATH
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MECHANICAL ENGINEER	JEFF LEWIS
PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

ELECTRICAL SITE PLAN

0 1" 2"

FILENAME E-001.dwg

SCALE 1" = 40'

SHEET **E-001**

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KEYNOTES (##)

1 PROVIDE ROUGH-IN JUNCTION BOX WITH A CONDUIT PATHWAY TO DATA CABINET IN DATA 102 WITH PULL STRING. CARD READER AND ASSOCIATED CABLING PROVIDED BY OTHERS.

2 CEILING CAMERA LOCATION, PROVIDE CONDUIT PATHWAY TO DATA CABINET IN DATA 102 WITH PULL STRING. CAMERA AND ASSOCIATED CABLING PROVIDED BY OTHERS.

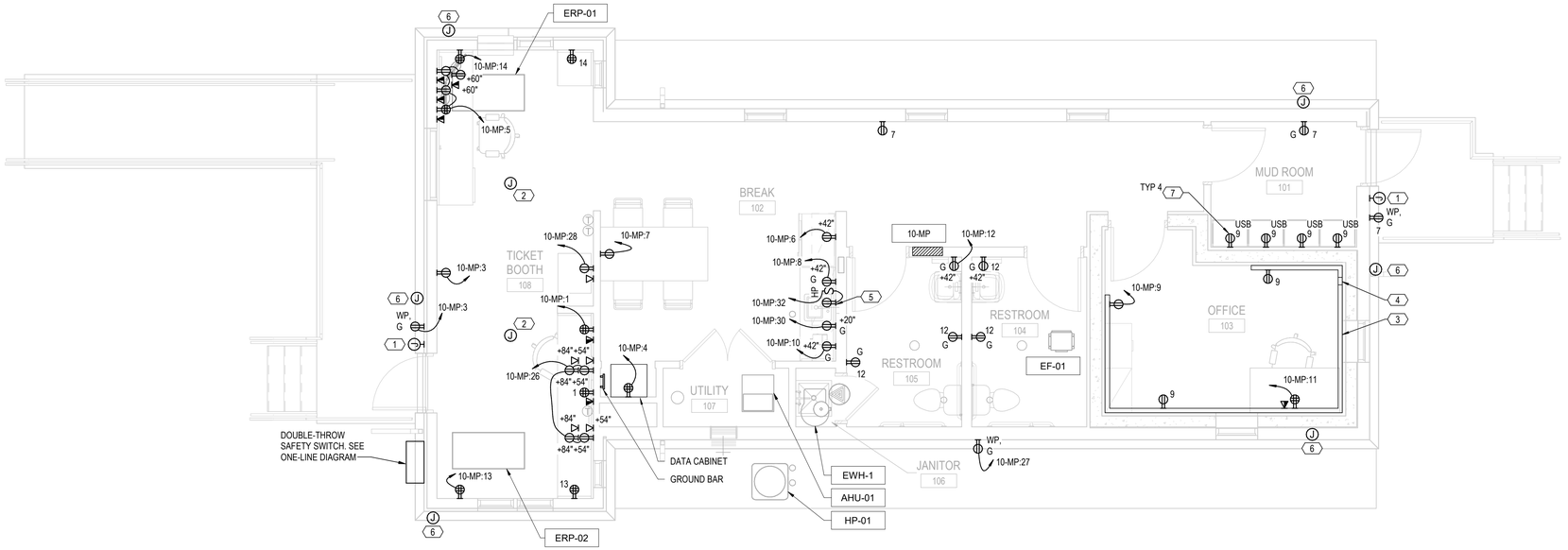
3 PROVIDE WIREMOLD 4000 SERIES IVORY COLORED COMBINATION POWER/DATA SURFACE METAL RACEWAY WITH DEVICES AT LOCATIONS SHOWN.

4 PROVIDE VERTICAL SECTION OF RACEWAY PER KEYNOTE 4 NEAR CORNER OF ROOM TO RISE UP ABOVE CEILING.

5 PROVIDE RECEPTACLE BELOW SINK WITH MATCHING CORD AND PLUG TO CONNECT GARBAGE DISPOSAL.

6 PROVIDE RECESSED JUNCTION BOX WITH WEATHERPROOF BLANK COVER AT 96" ABOVE FINISHED FLOOR LEVEL FOR FUTURE SECURITY CAMERA. PROVIDE 3/4" CONDUIT WITH PULL WIRE TO DATA CABINET.

7 PROVIDE SURFACE MOUNTED DEVICE BOX IN BACK OF LOCKER. COORDINATE HEIGHT AND LOCATION WITH LOCKER SUPPLIER TO CORRESPOND WITH SHELF IN LOCKER.



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Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ELECTRICAL POWER AND SYSTEMS PLAN

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE 1/4" = 1'-0"

SHEET E-101

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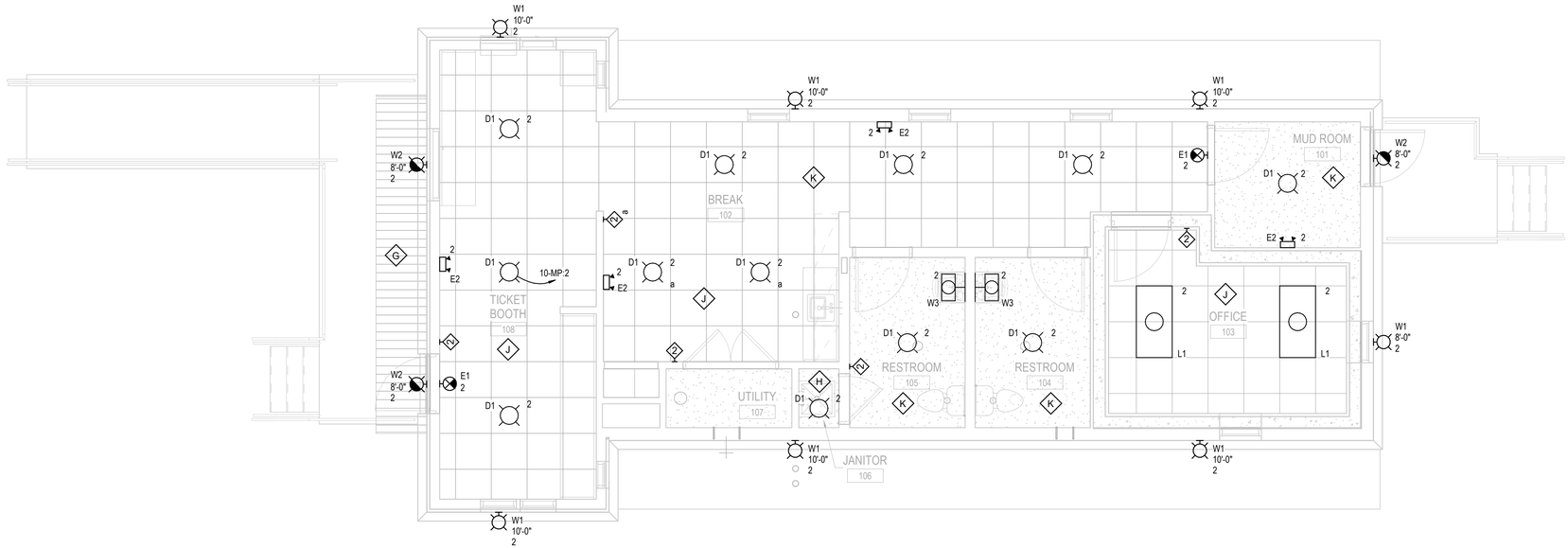

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Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ELECTRICAL LIGHTING PLAN

0 1" 2"

FILENAME 10386668-MEP.rvt

SCALE 1/4" = 1'-0"

SHEET
E-111

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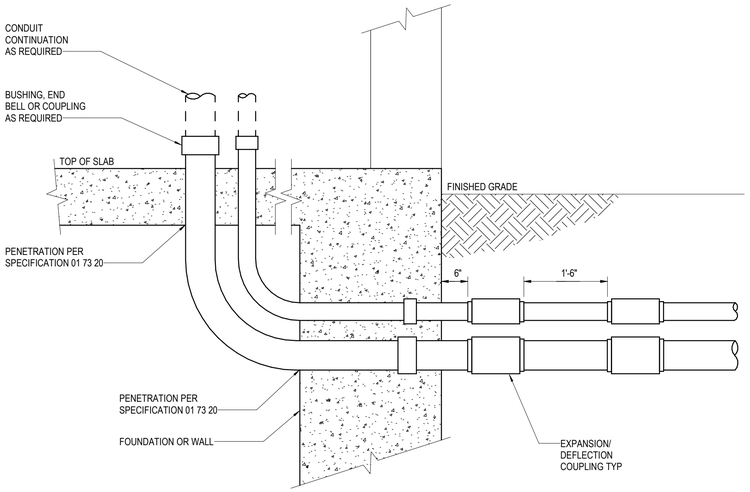
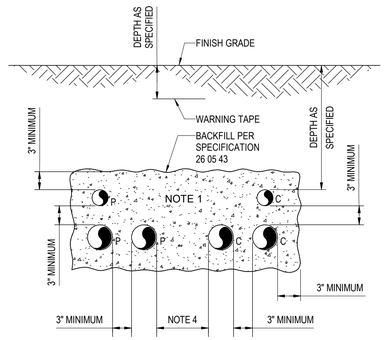


NOTES

1. SEE DUCTBANK DETAIL FOR ADDITIONAL REQUIREMENTS.

1 CONDUIT TRANSITION TO ABOVE GRADE (EXTERIOR TO INTERIOR)

NOT TO SCALE

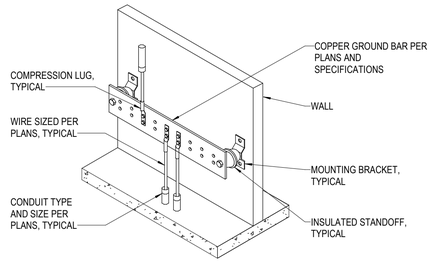


NOTES:

1. NUMBER OF CONDUITS AS REQUIRED FOR THE APPLICATION.
2. P SUBSCRIPT ELECTRICAL POWER OR CONTROL CONDUIT.
3. C SUBSCRIPT COMMUNICATION (TELEPHONE, DATA, INSTRUMENTATION) CONDUIT.
4. 6" MINIMUM WHEN POWER CONDUIT CONTAINS LESS THAN 1000V. 12" MINIMUM WHEN POWER CONDUIT CONTAINS MORE THAN 1000V.

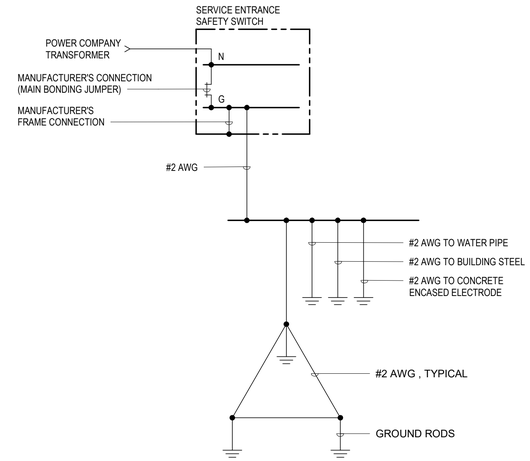
2 DIRECT BURIED CONDUIT(S) SECTION

NOT TO SCALE



3 GROUND BUS MOUNTING DETAIL

NOT TO SCALE



4 GROUNDING DIAGRAM

NOT TO SCALE

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PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ELECTRICAL DETAILS

0 1" 2"

FILENAME 10386668-MEP.rvt

SCALE NOT TO SCALE

SHEET E-501

Autodesk Docs://10386668_MWA_MPW_Scalehouse_Design_2022/10386668-MEP.rvt
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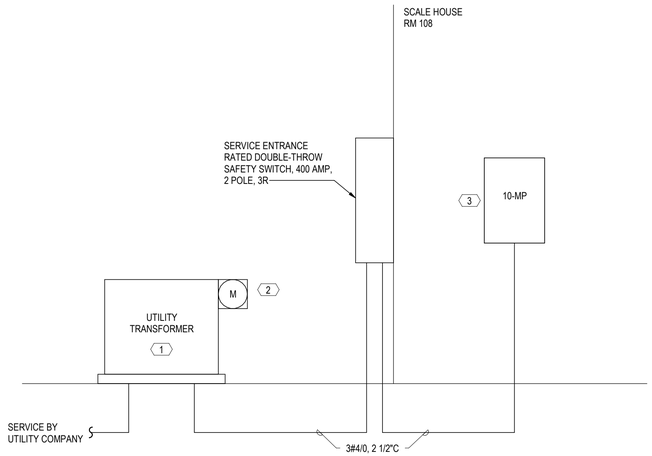

1 ELECTRICAL ONE-LINE RISER DIAGRAM

PANELBOARD NO: 10-MP

VOLTAGE:	120/240	**BUS RATING (A):**	225	**ENCLOSURE:**	NEMA 1
PHASE:	1	**MAIN OC DEVICE:**	225/2	**MOUNTING:**	RECESSED
WIRE:	3+GND	**INTERRUPTING RATING (KA):**	10	**LOCATION:**	ROOM 108
200% NEUTRAL:	NO	**SERVICE ENTRANCE LABEL:**	NO	**INTEGRAL SPD:**	YES

CKT NO.	DESCRIPTION	CONNECTED LOAD (VA) LTS	REC	MECH	MISC	OCP AMPS	P		OCP AMPS	P	CONNECTED LOAD (VA) LTS	REC	MECH	MISC	DESCRIPTION	CKT NO.
1	REC RM 108		720			20	1	A	20	1	649				LIGHTING	2
3	REC RM 108, EXT		360			20	1	B	20	1		360			REC DATA CABINET	4
5	REC RM 108		900			20	1	A	*20	1		500			REFRIGERATOR	6
7	REC RM 101, 102, EXT		720			20	1	B	20	1		180			REC RM 102	8
9	REC RM 103		1,260			20	1	A	20	1		180			REC RM 102	10
11	REC RM 103		360			20	1	B	20	1		720			REC RM 104, 105	12
13	REC RM 108		720			20	1	A	20	1		720			REC RM 108	14
15	EDH-01			7,500		100	2	B	15	2			360		ERP-01	16
17				7,500				A					360			18
19	AHU-01			564		15	2	B	15	2			360		ERP-02	20
21				564				A					360			22
23	DWH-01			3,000		40	2	B	15	1			180		EF-01	24
25				3,000				A	20	1		720			REC RM 108	26
27	REC EXTERIOR		200			20	1	B	20	1		180			REC RM 108	28
29	DRP-1			122		15	1	A	20	1		180			REC RM 102	30
31	HP-01			2,291		40	2	B	*20	1		180			GARBAGE DISPOSAL	32
33				2,291				A	20	1					SPARE	34
35	SPARE					20	1	B	20	1					SPARE	36
37	SPARE					20	1	A	20	1					SPARE	38
39	SPARE					20	1	B		2					SPD BRKR RATING PER MANUFACTURER	40
41	SPARE					20	1	A								42

LOAD SUMMARY

	LTS	REC	MECH	MISC	SPARE	TOTAL				PHASE BALANCE	
CONNECTED LOAD (KVA)	0.6	9.2	28.5	0.0	---	38.3		240	LINE-TO-LINE...	PHASE A (KVA)	21
DEMAND FACTOR	1.25	NEC	1.00	1.00	20%	---		159	CONNECTED AMPS	PHASE B (KVA)	18
DESIGN LOAD (KVA)	0.8	9.2	28.5	0.0	7.7	46.1		192	DESIGN AMPS		

* PROVIDE GFCI BREAKER

KEYNOTES (##)

1 PROVIDE FIBERGLASS TRANSFORMER PAD FOR UTILITY TRANSFORMER. COORDINATE WITH UTILITY COMPANY FOR SIZE AND REQUIREMENTS.

2 INSTALL METER SOCKET FURNISHED BY UTILITY COMPANY.

3 PROVIDE 2" CONDUIT WITH PULL WIRE FOR CONNECTION OF FUTURE SOLAR PANELS. COORDINATE LOCATION FOR FUTURE PANELS WITH OWNER AND STUB OUT CONDUIT ACCORDINGLY.

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PROJECT NUMBER	10386668

Metro Waste Authority

METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ELECTRICAL ONE-LINE RISER DIAGRAM AND PANEL SCHEDULE

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE NONE

SHEET E-601

LUMINAIRE SCHEDULE

DWG ID	MANUFACTURER AND SERIES	DESCRIPTION	WATTS (MAX)	VOLTAGE	COLOR TEMP (K)	CRI (MIN)	LUMENS DOWN	LUMENS UP	MOUNTING		ACCEPTABLE MANUFACTURES	NOTES
									TYPE	HEIGHT		
D1	PORTFOLIO (LD6C SERIES)	LED CEILING MOUNT DOWNLIGHT, DIMMABLE	32	120	4000	90	3000	-	RECESSED	-	ACUITY, WILLIAMS	
E1	LITHONIA LE SERIES	LED CEILING/WALL MOUNT DIE-CAST ALUMINUM EXIT SIGN WITH BRUSHED ALUMINUM FACE, RED LETTERS AND BATTERY BACK UP	1.34	120	-	-	-	-	WALL	10'-0"	DUAL-LITE, WILLIAMS	
E2	SURE-LITES (ALL-PRO AP2SQLED 30 SERIES)	LED WALL MOUNT EMERGENCY	1.5	120	-	-	-	-	WALL	8'-0"	ACUITY, WILLIAMS	
L1	METALUX (24FP LED SERIES)	LED 2X4 RECESSED FLAT PANEL, DIMMABLE	38.3	120	4000	80	4500	-	RECESSED	-	ACUITY, WILLIAMS	
W1	LITHONIA WDGE2 SERIES	LED WALL MOUNT WITH WIDE DISTRIBUTION WITH INTEGRAL PHOTOCELL AND MOTION SENSOR	10	120	4000	70	1289	-	WALL	AS NOTED	COOPER, WILLIAMS	1
W2	LITHONIA WDGE2 SERIES	EMERGENCY LED WALL MOUNT WITH WIDE DISTRIBUTION WITH INTEGRAL PHOTOCELL AND MOTION SENSOR, RATED -20 DEGREES C	10	120	4000	70	1289	-	WALL	8'-0"	COOPER, WILLIAMS	1
W3	SHAPER (605-W SERIES)	VANITY LED	20	120	4000	80	2000	-	WALL	1'-0" ABOVE MIRROR		

NOTES:

1. MOTION SENSOR SHALL BE PROGRAMMED FOR INSTANT ON AND 3 MINUTE FADE TO 50% POWER LEVEL AFTER ACTIVITY HAS NOT BEEN DETECTED FOR 15 MINUTES.

LIGHTING CONTROL STRATEGY SCHEDULE

DESIGNATION ON DRAWINGS	OCCUPANCY DETECTION						WALL CONTROL				TIME SWITCH CONTROL	LIGHT REDUCTION CONTROL	PHOTOCELL, LIGHTING SETBACK	DAYLIGHT SENSOR CONTROL - DIMMING	ROOM OR AREA TYPE	REMARKS	LIGHTING CONTROL STRATEGY DESCRIPTION
	CEILING MOUNT OCCUPANT DETECTION	LUMINAIRE OR POLE MOUNT OCCUPANT DETECTION	AUTO ON (50%)	AUTO ON (100%)	MANUAL ON (VACANCY SENSOR)	OCCUPANT DETECTION TIME-OUT (20 MIN. MAX)	ON / OFF	ON / OFF DIMMING	ON / OFF BI-LEVEL SWITCHING	ON / OFF DIMMING WITH PRESET SCENES							
G		•											•		EXTERIOR LIGHTING		C7
H	•				•	20	•								CLOSET, STORAGE, SMALL ROOMS		C8
J	•		•			20		•							OFFICE, BREAK ROOM, CONTROL ROOM		C10
K	•			•		20	•								CORRIDOR, RESTROOMS		C11

LIGHTING CONTROL SCHEDULE GENERAL NOTES:

1. WHERE DIMMING IS INDICATED FOR WALL CONTROL, PROVIDE ONE PUSHBUTTON STATION WITH TWO BUTTONS (UNLESS NOTED OTHERWISE) WITH ON / RAISE AND OFF / LOWER CONTROL FOR EACH LIGHTING ZONE SHOWN ON THE DRAWINGS. WHERE ONLY ON / OFF IS INDICATED FOR WALL CONTROL, PROVIDE A TWO BUTTON STATION WITH ON AND OFF. EACH SPACE SHALL HAVE A MINIMUM OF ONE ZONE OF CONTROL AND ADDITIONAL ZONES OF CONTROL ADDED AS SHOWN ON THE LIGHTING PLANS.
2. THE LIGHTING CONTROL DESIGINATION ON THE LIGHTING PLANS INDICATES THE TYPE OF CONTROL REQUIRED IN THE CORRESPONDING ROOM / AREA. THE MANUFACTURER SHALL DETERMINE THE QUANTITY AND LOCATION OF SENSORS AND ACCESSORIES NECESSARY FOR COMPLETE COVERAGE AND PROPER SYSTEM OPERATION. SEE DIGITAL LIGHTING CONTROL SYSTEM SPECIFICATION SECTION FOR FURTHER REQUIREMENTS.

LIGHTING CONTROL STRATEGY DESCRIPTION:

C7 EXTERIOR LIGHTING: PHOTOCELL TURNS LIGHTS ON AT DUSK AND OFF WHEN DAYLIGHT IS PRESENT. LIGHTS ARE AUTOMATICALLY DIMMED TO REDUCE LOAD BY 50% DURING TIME WHEN ACTIVITY HAS NOT BEEN DETECTED FOR 15 MINUTES.

C8 MANUAL ON / VACANCY OFF: OCCUPANT MANUALLY TURNS THE LIGHTS ON WHEN ENTERING THE SPACE. OCCUPANT CAN MANUALLY TURN LIGHTS OFF. UPON VACANCY THE LIGHTS TURN OFF AFTER TIMEOUT PERIOD.

C10 AUTO ON / MANUAL ADJUST / VACANCY OFF: OCCUPANT ENTERS SPACE AND LIGHTS AUTOMATICALLY TURN ON TO PERCENT OF FULL LIGHT OUTPUT INDICATED. OCCUPANT CAN MANUALLY ADJUST (RAISE OR LOWER) LIGHT LEVEL OR TURN LIGHTS ON / OFF. UPON SENSING VACANCY LIGHTS TURN OFF AFTER TIMEOUT PERIOD.

C11 AUTO ON / VACANCY OFF: OCCUPANT ENTERS SPACE AND LIGHTS AUTOMATICALLY TURN ON TO PERCENT OF FULL LIGHT OUTPUT INDICATED. UPON SENSING VACANCY LIGHTS TURN OFF AFTER TIMEOUT PERIOD.

MECHANICAL / ELECTRICAL COORDINATION SCHEDULE

ABBREVIATIONS:

A	AMPS	C	COMBINATION STARTER AND SAFETY SWITCH	E	ELECTRICAL CONTRACTOR	N1	NEMA 1
ENCL	ENCLOSURE	CB	CIRCUIT BREAKER	M	MECHANICAL CONTRACTOR	N3R	NEMA 3R
HP	HORSEPOWER	CP	CONTROL PANEL	NF	NON-FUSED	N4	NEMA 4
KW	KILOWATTS	IN	INTEGRAL WITH EQUIPMENT	VFD	VARIABLE FREQUENCY DRIVE	N4X	NEMA 4X
PH	PHASE	S	HP RATED TOGGLE OR ROTARY SWITCH			N7	NEMA 7
V	VOLTAGE	SS	SAFETY SWITCH, FUSED			N9	NEMA 9
W	WATTS	SSN	SAFETY SWITCH, NON-FUSED			N12	NEMA 12

EQUIPMENT			ELECTRICAL SYSTEM				DISCONNECT				CONTROLLER			REMARKS
TAG	DESCRIPTION	LOAD	VOLTS	PHASE	WIRE, CONDUIT	PANEL: CIRCUIT	FURNISHED BY/ INSTALLED BY	TYPE	RATING (AMPS)	ENCL	FURNISHED BY/ INSTALLED BY	TYPE	ENCL	
AHU-01	AIR HANDLING UNIT	0.5HP	240	1	2#12, 1#12G, 3/4"C	10-MP:19,21	E/E	SS	30	N1	M/IN	-	-	
DRP-1	DOMESTIC RECIRC PUMP	122VA	120	1	2#12, 1#12G, 3/4"C	10-MP:29	E/E	S	20	N1	M/M	-	-	
DWH-01	WATER HEATER	6000VA	240	1	2#8, 1#10, 3/4"C	10-MP:23,25	E/E	SS	60	N1	M/IN	-	-	
EDH-01	ELECTRIC DUCT HEATER	15000VA	240	1	2#2, 1#8G, 1-1/4"C	10-MP:15,17	E/E	SS	100	N1	M/IN	-	-	
EF-01	EXHAUST FAN	180VA	120	1	2#12, 1#12G, 3/4"C	10-MP:24	-	-	-	-	M/M	VFD	N1	1
ERP-01	ELECTRIC RADIANT PANEL	720VA	240	1	2#12, 1#12G, 3/4"C	10-MP:16,18	E/E	-	-	-	M/E	-	-	2
ERP-02	ELECTRIC RADIANT PANEL	720VA	240	1	2#12, 1#12G, 3/4"C	10-MP:20,22	E/E	-	-	-	M/E	-	-	2
HP-01	HEAT PUMP	19A	240	1	2#8, 1#10G, 3/4"C	10-MP:31,33	E/E	SS	30	N3R	M/IN	-	-	

GENERAL NOTES:

A. VERIFY/COORDINATE RATINGS FOR EQUIPMENT SUPPLIED BY THE SELECTED MANUFACTURER. WHERE RATINGS ARE OTHER THAN AS INDICATED FOR SPECIFIED UNIT, DISCONNECTS, MOTOR STARTERS, OVERCURRENT DEVICES AND RELATED REVISIONS SHALL BE PROVIDED ACCORDINGLY. THE CONTRACTOR THAT FURNISHES EQUIPMENT WITH RATINGS OTHER THAN AS NOTED SHALL BE RESPONSIBLE FOR COORDINATION AND COSTS FOR REVISIONS TO ACCOMMODATE SELECTED EQUIPMENT.

B. FRACTIONAL HORSEPOWER SINGLE PHASE MOTORS SHALL BE PROVIDED WITH INTEGRAL OVERLOAD PROTECTION.

C. VARIABLE FREQUENCY DRIVES SHALL BE FURNISHED WITH INTEGRAL DISCONNECT.

D. WHERE FUSED SAFETY SWITCHES ARE INDICATED, PROVIDE FUSES SIZED PER MANUFACTURERS RECOMMENDATIONS.

E. ELECTRICAL CONTRACTOR SHALL PROVIDE CIRCUIT TO EQUIPMENT AS INDICATED.

F. WHERE DISCONNECT IS NOT SHOWN ON PLANS, LOCATE AT EQUIPMENT PER NEC.

G. MOTORS RATED 120 VOLT AND LESS THAN 1/3 HP SHALL HAVE 15/1 BRANCH CIRCUIT BREAKER IN PANEL. MOTORS RATED 120 VOLT, 1/3 HP AND LARGER SHALL HAVE 20/1 BRANCH CIRCUIT BREAKER IN PANEL.

H. REFER TO SPECIFICATIONS FOR SHORT CIRCUIT CURRENT RATING (SCCR) FOR EQUIPMENT.

I. REFER TO SPECIFICATIONS SECTION 23 09 00 FOR ADDITIONAL WIRING REQUIREMENTS, SUCH AS DAMPER OPERATORS.

REMARKS

1. VARIABLE SPEED SWITCH SERVES AS DISCONNECT.
2. PROVIDE BREAKER LOCK OFF DEVICE IN PANEL TO SERVE AS DISCONNECT. ELECTRICAL SHALL INSTALL LINE VOLTAGE THERMOSTAT FURNISHED BY MECHANICAL.

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METRO PARK WEST
SCALE HOUSE DESIGN

SCALE HOUSE
ELECTRICAL SCHEDULES

0 1" 2"

FILENAME 10386668-MEP.rvt
SCALE NONE

SHEET E-602

APPENDIX A

DRAWINGS