

# Project Manual

## Bidding

### Bonner County Solid Waste Colburn Facility Improvements

Contract No. \_\_\_\_\_

- ☐ Bid Bond
- ☐ Bid Sheets and Signature Page
- ☐ Acknowledgement of Addenda

February 2023

Prepared by:



Set No.: \_\_\_\_\_  
Project 4-21115

# PROJECT MANUAL

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## Bonner County Solid Waste Colburn Facility Improvements

### Bidding

BONNER COUNTY, IDAHO

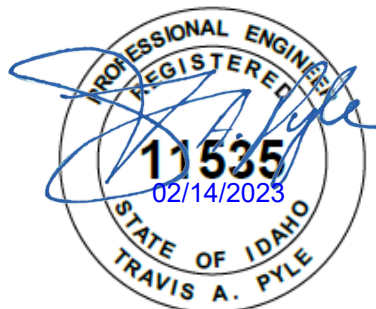
February 2023

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Travis Pyle, PE





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# **DIVISION 0**

## **BIDDING AND CONTRACTING REQUIREMENTS**

## SECTION 00100

### INVITATION TO BID

Separate sealed bids for construction of the Bonner County Solid Waste Colburn Facility Improvements will be received by the Board of County Commissioners at the Bonner County Commissioner's Office Suite 308 of the Administration Building at 1500 HWY 2, Sandpoint, Idaho 83864 until 10:00 am (local time) on March 24<sup>th</sup>, 2023, and then publicly opened and read aloud.

The project consists of improvements to the Colburn Facility.

The contract documents, consisting of half size Drawings and Project Manual, may be examined or obtained at the office of Bonner County Solid Waste, located at 1500 HWY 2, Suite 101, phone (208) 255-5681 in accordance with Article 2.1 of Instructions to Bidders. Required fee of \$50 per set, which is not refundable. Alternately, Prospective Bidders can download digital documents for free by calling Spencer Ferguson, PE/Bonner County Engineering Department at (208) 255-5681, ext. 2121 to get on the Plan Holder's List and request the link and password. Prospective Bidders must be put on the Plan Holder's List to Bid and be notified of changes or addendum(s).

In addition, the contract documents may also be examined at the following locations:

Spokane Regional Plan Center

All official notifications, addenda, and other Bidding Documents will be offered only by email, or a share file link emailed to the Plan Holders. Neither the Owner nor Engineer will be responsible for Bidding Documents, including addendum, if any, obtained from sources other than direct distribution by Bonner County.

There will be a non-mandatory Pre-Bid Conference at the office of Bonner County Solid Waste, located at 1500 HWY 2, Suite 101 on March 7, 2023, at 8:00 am (local time). Interested Contractors are encouraged to attend.

Contractor and any of the Contractor's Subcontractors bidding or doing work on this project shall be licensed in Idaho and will be required to be registered with the Idaho Division of Building Safety (DBS). Forms for registration are available from the Division of Building Safety at, 1090 E. Watertower St. Suite 150, Meridian, ID 83642. Information on registration can be obtained by calling (208) 334-3950. The Contractor must ensure that employees and applicants for employment are not discriminated against because of their race, color, religion, sex, or national origin. There are no special wage rates for this project.

Each bid must be accompanied by a Certified Check, Cashier's Check, or Bid Bond payable to Bonner County Board of Commissioners in an amount not less than ten percent (10%) of the total amount of the bid. Successful Bidders shall furnish an approved Performance Bond and a Labor and Materials Payment Bond, each in the amount of one hundred percent (100%) of the contract amount. Insurance, as required, shall be provided by the successful Bidder(s) and a certificate(s) of that insurance shall be provided.

This project is funded in part or in whole with loan funding from USDA Rural Development.

Davis-Bacon Wage Rates will not be applicable to this project.

Award of the project will be contingent upon receiving funding and award concurrence from USDA Rural Development. Bids may only be withdrawn as provided in Section 16.02 of the Instructions to Bidders

after the scheduled time for the public opening of bids.

The right is reserved to reject any or all proposals received, to waive informalities, to postpone the award of the contract for a period not to exceed sixty (60) days, and to accept the lowest responsive and responsible bid that is in the best interest of the Owner.

All questions about the meaning or intent of the Contract Documents are to be submitted in writing to and must be received by Great West Engineering no later than 4:00 pm (local time) on March 15<sup>th</sup>, 2023. Questions received after this date will not be answered. Oral questions will only be accepted at the Pre-Bid conference. Written comments may be submitted to Travis Pyle, PE of Great West Engineering, email at: [tpyle@greatwesteng.com](mailto:tpyle@greatwesteng.com). It is the Bidder's responsibility to ensure that questions or comments have been received by email reply from Mr. Pyle. If a reply has not been received within 24 hours, contact Spencer Ferguson, Manager of the Bonner County Engineering Department at (208) 255-5681, ext. 2121 or at [spencer.ferguson@bonnercountyid.gov](mailto:spencer.ferguson@bonnercountyid.gov). 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. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

Bonner County is an Equal Opportunity Employer.

American Iron and Steel - Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials.

The following waivers apply to this Contract:

- De Minimis,
- Minor Components, and
- Pig iron and direct reduced iron.

Published at the Bonner County Daily Bee, Idaho and Spokesman Review, Washington on the 24<sup>th</sup> day of February 2023 and 3<sup>rd</sup> day of March 2023.

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Bob Howard

Director, Bonner County Solid Waste

(Title)

1500 Highway 2, Suite 101, Sandpoint, ID 83864

(Address)

**END OF SECTION**

## SECTION 00200

### INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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## 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, and which registers plan holders.

## ARTICLE 2—BIDDING DOCUMENTS

- 2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.
- 2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.
- 2.03 Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.
- 2.04 Bidder may register as a plan holder and obtain complete sets of Bidding Documents, in the number and format stated in the Advertisement or invitation to bid, from the Issuing Office. Bidders may rely that sets of Bidding Documents obtained from the Issuing Office are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.
- 2.05 Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as plan holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding Documents or other

documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.

## 2.06 *Electronic Documents*

- A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.
  - 1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader. It is the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.
- B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.
- ~~C. After the Contract is awarded, the Owner will provide or direct the Engineer to provide for the use of the Contractor documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats.~~
  - ~~1. Electronic Documents that are available in native file format include:
    - a. **[List documents that will be made available to Contractor]**~~
  - ~~2. Release of such documents will be solely for the convenience of the Contractor. No such document is a Contract Document.~~
  - ~~3. Unless the Contract Documents explicitly identify that such information will be available to the Successful Bidder (Contractor), nothing herein will create an obligation on the part of the Owner or Engineer to provide or create such information, and the Contractor is not entitled to rely on the availability of such information in the preparation of its Bid or pricing of the Work. In all cases, the Contractor shall take appropriate measures to verify that any electronic/digital information provided in Electronic Documents is appropriate and adequate for the Contractor's specific purposes.~~
  - ~~4. In no case will the Contractor be entitled to additional compensation or time for completion due to any differences between the actual Contract Documents and any related document in native file format.~~

## ARTICLE 3—QUALIFICATIONS OF BIDDERS

- 3.01 To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within **seven (7)** days of Owner's request, Bidder must submit the following information:
- A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.
  - B. A written statement that Bidder is authorized to do business in the state where the Project is located, ~~or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.~~
  - C. Bidder's state or other contractor license number, if applicable.
  - D. Subcontractor and Supplier qualification information.
    - 1. List of Project References

- 3.02 ~~Prospective Bidders must submit required information regarding their qualifications by **insert deadline for prequalification submittals**. Owner will review the submitted information to determine which contractors are qualified to bid on the Work. Owner will issue an Addendum listing those contractors that Owner has determined to be qualified to construct the project. Bids will only be accepted from listed contractors. The information that each prospective Bidder must submit to seek prequalification includes the following:~~

- ~~A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.~~
- ~~B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.~~
- ~~C. Prospective Bidder's state or other contractor license number, if applicable.~~
- ~~D. Subcontractor and Supplier qualification information.~~
- ~~E. Other required information regarding qualifications.~~

### **Deleted**

- 3.03 ~~Bidder is to submit the following information with its Bid to demonstrate Bidder's qualifications to perform the Work:~~
- ~~A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.~~
  - ~~B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.~~
  - ~~C. Bidder's state or other contractor license number, if applicable.~~
  - ~~D. Subcontractor and Supplier qualification information.~~
  - ~~E. Other required information regarding qualifications.~~

- 3.04 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.05 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

#### **ARTICLE 4—PRE-BID CONFERENCE**

- 4.01 ~~A pre-bid conference will not be conducted for this Project.~~
- 4.02 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or Invitation to Bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.
- 4.03 ~~A mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.~~
- 4.04 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

#### **ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE**

##### **5.01 *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.

##### **5.02 *Existing Site Conditions***

###### **A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions***

- 1. The Supplementary Conditions and/or Special Provisions identify the following regarding existing conditions at or adjacent to the Site:
  - a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.
  - b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface

structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.

- 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 and/or Special Provisions. 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 and/or Special Provisions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.
4. *Geotechnical Baseline Report/Geotechnical Data Report*: The Bidding Documents contain a Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).
- a. As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations ("Baseline Conditions"). The GBR is a Contract Document.
  - b. The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.
  - c. Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.
  - d. As set forth in the Supplementary Conditions, the GDR is a Contract Document containing data prepared by or for the Owner in support of the GBR.
- B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

### 5.03 *Other Site-related Documents*

- A. In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:

- 1. **Geotechnical Report (refer to Appendix 1 of the Project Manual)**

- Owner will make copies of these other Site-related documents available to any Bidder on request.

- B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.
- C. The other Site-related documents are not part of the Contract Documents.
- D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.
- E. No other Site-related documents are available.

### 5.04 *Site Visit and Testing by Bidders*

- A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.
- B. A Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference.
- ~~C. A Site visit is scheduled for [designate, date, time and location]. Maps to the Site will be made available upon request.~~
- D. Bidders visiting the Site are required to arrange their own transportation to the Site.
- E. All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer contact for visiting the Site: Spencer Ferguson, PE Manager of the Bonner County Engineering Department at (208) 255-5681, Ext. 2121 or at [spencer.ferguson@bonnercountyid.gov](mailto:spencer.ferguson@bonnercountyid.gov). Bidder must conduct the required Site visit during normal working hours.
- F. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- G. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general 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. Bidder is responsible for establishing access needed to reach specific selected test sites.

- H. Bidder must 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.
- I. Bidder must fill and compact all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

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

5.06 *Other Work at the Site*

- A. Reference is made to Article 8 of the Supplementary Conditions and the Special Provisions 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 6—BIDDER'S REPRESENTATIONS AND CERTIFICATIONS**

6.01 *Express Representations and Certifications in Bid Form, Agreement*

- A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder's examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.
- B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

6.02 Responsibilities of each Bidder Before Submitting a Bid:

- 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 including but not limited to those general and local conditions affecting transportation, disposal, handling and storage facilities, availability of labor, utilities, roads, climatic conditions and seasons, physical conditions at the Site and project area a whole, Site topography and ground conditions, equipment and facilities needed prior to and during execution 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 and/or Special Provisions, 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 and/or Special Provisions, 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 7—INTERPRETATIONS AND ADDENDA**

- 7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.
- 7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:
  - A. All questions about the meaning or intent of the Bidding Documents are to be submitted to Engineer in writing and must be received by no later than 4:00 pm (local time) on March 15<sup>th</sup>, 2023. Written comments may be submitted to Travis Pyle, PE of Great West Engineering,



email at: tpyle@greatwesteng.com. It is the Bidder's responsibility to ensure that questions or comments have been received by email reply from Mr. Pyle. If a reply has not been received within 24 hours, contact Spencer Ferguson, PE Manager of the Bonner County Engineering Department at (208) 255-5681, ext. 2121 or at [spencer.ferguson@bonnercountyid.gov](mailto:spencer.ferguson@bonnercountyid.gov).

- 7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.
- 7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

#### **ARTICLE 8—BID SECURITY**

- 8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of ten (10%) percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety authorized to do business in Idaho meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents. **Bid security must be at least 10% of the Bidder's maximum Bid price.**
- 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, 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 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 the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner's damages in the case of a damages-form bond. Such forfeiture will be Owner's exclusive remedy if Bidder defaults.
- 8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.
- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

#### **ARTICLE 9—CONTRACT TIMES**

- 9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.
- 9.02 ~~Bidder must set forth in the Bid the time by which Bidder must achieve Substantial Completion, subject to the restrictions established in Paragraph 13.07 of these Instructions. The Owner will~~

take Bidder's time commitment regarding Substantial Completion into consideration during the evaluation of Bids, and it will be necessary for the apparent Successful Bidder to satisfy Owner that it will be able to achieve Substantial Completion within the time such Bidder has designated in the Bid. ~~[If applicable include the following: Bidder must also set forth in the Bid its commitments regarding the achievement of Milestones and readiness for final payment.]~~ The Successful Bidder's time commitments will be entered into the Agreement or incorporated in the Agreement by reference to the specific terms of the Bid.

- 9.03 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 10—SUBSTITUTE AND “OR EQUAL” ITEMS

- 10.01 ~~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.~~
- 10.02 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those “or-equal” or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an “or-equal” or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. **Each such request shall include the Manufacturer's Certification for Compliance with AIS. Refer to the Manufacturer's Certification form provided in these construction Contract Documents.** The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner. **Substitutes and “or-equal” materials and equipment may be proposed by Contractor in accordance with Paragraphs 7.05 and 7.06 of the General Conditions after the Effective Date of the Contract. Each such request shall include Manufacturer's Certification letter to document compliance with AIS requirements of Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.**
- 10.03 All prices that Bidder sets forth in its Bid will 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 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS**

- 11.01 ~~A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.~~

##### **Deleted**

- 11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work with the signed bid form:

- A. **Pre-Engineered Metal Building Manufacturer / Supplier**
- B. **Pre-Engineered Metal Building Erector**
- C. **Paving Contractor**
- D. **Plumbing Contractor**
- E. **Concrete Contractor**
- F. **Heating and Air Conditioning Contractor**
- G. **Electrical Contractor**
- H. **Carpenter / Framer**
- I. **Any additional subcontractor or supplier performing work in excess of \$50,000.**

- 11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will 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.

- 11.04 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 and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, 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 7.07 of the General Conditions.

- 11.05 – The Contractor shall not award work to Subcontractor(s) in excess of the limits stated in SC 7.07A.**

## ARTICLE 12—PREPARATION OF BID

- 12.01 The Bid Form is included with the Bidding Documents. Paper copies of the Bidding Documents are available through the Bonner County Solid Waste, located at 1500 HWY 2, Suite 101, Sandpoint, ID, or by Spencer Ferguson, PE Manager of the Bonner County Engineering Department at (208) 255-5681, ext. 2121 or at [spencer.ferguson@bonnercountyid.gov](mailto:spencer.ferguson@bonnercountyid.gov)
- A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must 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.”
- 12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.
- 12.03 A Bid by a corporation must 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 must be shown.
- 12.04 A Bid by a partnership must 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 official address of the partnership must be shown.
- 12.05 A Bid by a limited liability company must 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 official address of the firm must be shown.
- 12.06 A Bid by an individual must show the Bidder’s name and official address.
- 12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.
- 12.08 All names must be printed in ink below the signatures.
- 12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.
- 12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.
- 12.11 The Bid must contain evidence of Bidder’s authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.

- 12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's ~~state contractor license number~~ current Idaho Contractor's Public Works License Number, if any, must also be shown on the Bid Form.

## ARTICLE 13—BASIS OF BID

**The work is comprised of bid schedules consisting of lump sum and unit price bid items with some add alternate(s). Owner may select any one or combination of these schedules and add alternate(s) for Contractor selection and awarding the contract.**

### 13.01 *Lump Sum*

- A. Bidders must submit a Bid on a lump sum basis for bid items as set forth in the bid schedule included in the Bid Form.
- B. The Bid will not be considered unless the Bid Form is complete, containing all lump sum prices for each Bid item included in the Bid Form, and Bids and totals are shown legibly in their proper locations. The total amount of the Bid shall be legibly written and numerically presented in the proper place, and the Bid Form shall be manually signed.

### 13.02 ~~Base Bid Schedules~~ *with Alternates*

- A. Bidders must submit a Bid on a lump sum or unit price basis for the ~~base~~ Bid schedules and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.
- ~~B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.~~

### 13.03 ~~Sectional Bids~~ *Deleted*

### 13.04 ~~Cost-Plus-Fee Bids~~ *Deleted*

### 13.05 *Unit Price*

- A. Bidders must submit a Bid on a unit price basis for each item of Work listed in ~~the unit price section of~~ bid schedule included in the Bid Form.
- B. The Bid will not be considered unless the Bid Form is complete, containing all unit prices for each Bid item included in the Bid Form, and Bids and totals are shown legibly in their proper locations. The total amount of the Bid shall be legibly written and numerically presented in the proper place, and the Bid Form shall be manually signed.
- C. 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.

- D. 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. Discrepancies between words and figures will be resolved in the favor of words.

13.06 *Allowances*

- A. For cash allowances the Bid price must include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

13.07 ~~*Price-Plus-Time Bids*~~ Deleted

**ARTICLE 14—SUBMITTAL OF BID**

- 14.01 The Bidding Documents include one ~~separate unbound~~ bound copy of the Bid Form, and, if required, the Bid Bond Form. ~~The unbound copy of the Bid Form is to be~~ The bound copy of the Bid Form may be removed from the Bidding Documents or a copy may be produced. The form shall be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.
- 14.02 The Bidding Documents are available and may be submitted electronically at QuestCDN.com.
- 14.03 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid. Hard copy bids must 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 must 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 must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the ~~Advertisement~~ Invitation to Bid.
- A. A Bid will not be considered unless accompanied by the proper Bid Security in accordance with Article 8 of these Instructions to Bidders.
- B. Bids, Bid Securities, or bid modifications submitted by electronic transmission (such as fax or e-mail) will not be considered.
- 14.04 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 15—MODIFICATION AND WITHDRAWAL OF BID**

- 15.01 An unopened 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.

- 15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 15.03 ~~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, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.~~

After the date and time Bids are opened, a bid may only be withdrawn in accordance with Idaho Code 54-1904. This provision to withdraw a Bid without forfeiting the Bid security does not apply to Bidder's errors in judgment in preparing the Bid.

#### **ARTICLE 16—OPENING OF BIDS**

- 16.01 Bids will be opened at the time and place indicated in the ~~advertisement or invitation to bid~~ Invitation to Bid and, unless obviously non-responsive, 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.
- 16.02 ~~Bids will be opened privately.~~

#### **ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE**

- 17.01 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 18—EVALUATION OF BIDS AND AWARD OF CONTRACT**

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.
- 18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.
- 18.03 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, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.

18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.

18.05 *Evaluation of Bids*

- A. In evaluating Bids, Owner will consider whether 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. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner will announce to all bidders a “Base Bid plus alternates” budget after receiving all Bids, but prior to opening them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.
- C. For determination of the apparent low Bidder(s) when sectional bids are submitted, Bids will be compared on the basis of the aggregate of the Bids for separate sections and the Bids for combined sections that result in the lowest total amount for all of the Work.
- D. 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.
- E. **Deleted**
- F. **Deleted**

18.06 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.

18.07 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 19—BONDS AND INSURANCE**

19.01 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, other required bonds (if



any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

- 19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

## **ARTICLE 20—SIGNING OF AGREEMENT**

- 20.01 When Owner issues a Notice of Award to the Successful Bidder, it will 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 must 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 10 days thereafter, Owner will 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 21—SALES AND USE TAXES**

- 21.01 ~~Owner is exempt from [name of state] state sales and use taxes on materials and equipment to be incorporated in the Work. (Exemption No. [number]). Said taxes must not be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information. 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.~~

## **ARTICLE 22—CONTRACTS TO BE ASSIGNED**

- 22.01 ~~Bidder's attention is directed to the provisions of Article 5 of the Procurement Agreement which provide for the assignment of the Procurement Contract to a construction contractor designated by the Buyer to construct the [ ]. Successful Bidder (Seller) will be required to perform the Procurement Contract after it has been assigned to the construction contractor (Contractor Assignee) in accordance with the provisions in the Procurement Contract. Timing of the assignment is addressed in the Procurement Agreement. Forms documenting the assignment of the Procurement Contract and for the agreement of the Seller's surety to such assignment are included as attachments to the Procurement Agreement.~~

## **ARTICLE 23—FEDERAL REQUIREMENTS**

- 23.01 If the contract price is in excess of \$100,000, provisions of the Contract Work Hours and Safety Standards Act at 29 CFR 5.5(b) apply.
- 23.02 Federal requirements at Article 19 of the Supplementary Conditions apply to this Contract.
- 23.03 American Iron and Steel requirements apply to this project.

## **ARTICLE 24—WAGE REQUIREMENTS- DELETED**

## SECTION 00400

### BID FORM

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#### Section 00400 - Bid Form

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

## ARTICLE 1—OWNER AND BIDDER

1.01 This Bid is submitted to:

***Bonner County Board of Commissioners  
Commissioners Office, Suite 308  
1500 Highway 2  
Sandpoint, Idaho 83864***

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—ATTACHMENTS TO THIS BID

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

- A. Required Bid security;
- B. List of Proposed Subcontractors;
- C. List of Proposed Suppliers;
- D. List of Project References
- E. Evidence of authority to do business in the state of the Project; ~~or a written covenant to obtain such authority within the time for acceptance of Bids;~~
- F. Contractor's license number No.: ~~as evidence of Bidder's State Contractor's License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;~~
- G. Required Bidder Qualification Statement with supporting data; ~~and~~
- H. ~~[List other documents and edit above as pertinent].~~
- I. If Bid amount exceeds \$10,000, signed Compliance Statement (RD 400-6). Refer to specific equal opportunity requirements set forth in the Supplementary Conditions of the Construction Contract (EJCDC C-800). The RD 400-6 Form is included in the RD Modifications document below. By signing the bid form, the bidder represents that (s)he is also signing the RD 400-6 Form, if applicable, depending on the bid amount;
- J. If Bid amount exceeds \$25,000, signed Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048). The AD-1048 Form is included in the RD Modifications document below. By signing the bid form, the bidder represents that (s)he is also signing the AD-1048 Form, if applicable, depending on the bid amount;
- K. If Bid amount exceeds \$100,000, signed RD Instruction 1940-Q Exhibit A-1, Certification for Contracts, Grants, and Loans. The 1940-Q, Exhibit A-1 Form is included in the RD Modifications document below. By signing the bid form, the bidder represents that (s)he is also signing the 1940-Q, Exhibit A-1 Form, if applicable, depending on the bid amount
- L. Naming of Subcontractors:

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### Section 00400 - Bid Form

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

The sub-contractors to whom sub-contracts will be awarded if the bidder is awarded a contract are:  
(Insert "self" if properly licensed and so intended. Insert "Not required" if such specialty work is not  
required).

Pre-Engineered Metal Building Manufacturer / Supplier

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Contractor License

Number: \_\_\_\_\_

Pre-Engineered Metal Building Erector

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Contractor License

Number: \_\_\_\_\_

Paving Contractor

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Contractor License

Number: \_\_\_\_\_

Plumbing Contractor

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Contractor License

Number: \_\_\_\_\_

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Concrete Contractor

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Contractor License  
Number: \_\_\_\_\_

Heating and Air Conditioning Contractor

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Contractor License  
Number: \_\_\_\_\_

Electrical Contractor

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Contractor License  
Number: \_\_\_\_\_

Carpenter / Framer

Name: \_\_\_\_\_  
Address: \_\_\_\_\_  
Contractor License  
Number: \_\_\_\_\_

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(Note: If the owner is a City, County or School District, failure to name the plumbing, HVAC and electrical subcontractors may render the bid “non-responsive” under State Law IC 67-2310)

M. ~~[List other documents and edit above as pertinent].~~

### ARTICLE 3—BASIS OF BID

#### 3.01 Lump Sum and Unit Price Bid Items

- A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s) and unit prices.
- B. Bidder will perform the Work at the indicated prices. The Work has been organized into Schedule A (**BASE BID SCHEDULE**) and four bid alternate schedules (Schedules B-E).
- C. Refer to Section 01275, Measurement and Payment for a description of the bid items, how the items will be measured, and how the items will be paid.

#### D. SCHEDULE A – WASTE TRANSFER BUILDINGS (**BASE BID SCHEDULE**)

- 1. The following items are included in this schedule of Work:

Item No.	Description <sup>(1)</sup>	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
A1	General Conditions	LS	1	\$	\$
A2	Temporary Facilities and Controls	LS	1	\$	\$
A3	Site Work	LS	1	\$	\$
A4	New WTB <sup>(2)</sup>	LS	1	\$	\$
A5	Existing WTB Rehabilitation	LS	1	\$	\$
A6	Existing Operations Road Improvements	LS	1	\$	\$
A7	Gravel Surfacing	CY	440	\$	\$
A8	Asphalt Paving	SF	57,800	\$	\$
<b>TOTAL =</b>					<b>\$</b>

- 2. The following are Bid Add Alternative Item(s) for this schedule that may be included in the project at the discretion of the Owner:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
A9*	Stationary Crane	LS	1	\$	\$

#### E. SCHEDULE B – NEW CFC REMOVAL BUILDING (**BID ALTERNATE SCHEDULE**)

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1. The following items are included in this schedule of Work.

Item No.	Description <sup>(1)</sup>	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
B1	General Conditions	LS	1	\$	\$
B2	Temporary Facilities and Controls	LS	1	\$	\$
B3	Site Work	LS	1	\$	\$
B4	CFC Removal Building	LS	1	\$	\$
B5	Gravel Surfacing	CY	500	\$	\$
B6	Asphalt Paving	SF	41,500	\$	\$
B7	Chain Link Fencing and Gate	LF	2,900	\$	\$
<b>TOTAL =</b>					<b>\$</b>

**F. SCHEDULE C – NEW HHW FACILITY (BID ALTERNATE SCHEDULE)**

1. The following items are included in this schedule of Work:

Item No.	Description <sup>(1)</sup>	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
C1	General Conditions	LS	1	\$	\$
C2	Temporary Facilities and Controls	LS	1	\$	\$
C3	Site Work	LS	1	\$	\$
C4	HHW Building (Partial Build) <sup>(2)</sup>	LS	1	\$	\$
<b>TOTAL =</b>					<b>\$</b>

2. The following are Bid Add Alternative Item(s) for this schedule that may be included in the project at the discretion of the Owner:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
C5*	HHW Facility (Complete Build)	LS	1	\$	\$

**G. SCHEDULE D – NEW OPERATIONS ROAD (BID ALTERNATE SCHEDULE)**

1. The following items are included in this schedule of Work:

Item No.	Description <sup>(1)</sup>	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
D1	General Conditions	LS	1	\$	\$
D2	Temporary Facilities and Controls	LS	1	\$	\$
D3	Site Work	LS	1	\$	\$
D4	Asphalt Paving	SF	14,600	\$	\$
D5	Chain Link Gate	LS	1	\$	\$
<b>TOTAL =</b>					<b>\$</b>

**H. SCHEDULE E – METALS COLLECTION AREA (BID ALTERNATE SCHEDULE):**

1. The following items are included in this schedule of Work:

Item No.	Description <sup>(1)</sup>	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
E1	General Conditions	LS	1	\$	\$
E2	Temporary Facilities and Controls	LS	1	\$	\$
E3	Site Work	LS	1	\$	\$
E4	Gravel Surfacing	CY	70	\$	\$
E5	Asphalt Paving	SF	18,700	\$	\$
<b>TOTAL =</b>					<b>\$</b>

**I. Bidder acknowledges that:**

- Each Bid Lump Sum and Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and
- Estimated quantities for Unit Price Items are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.



3.02 *Total Base Bid Price Summary (Total of all Schedules Lump Sum and Unit Prices Items)*

<b>Schedule A (BASE BID SCHEDULE)</b>	<b>\$</b>
Schedule B (BID ALTERNATE SCHEDULE)	\$
Schedule C (BID ALTERNATE SCHEDULE)	\$
Schedule D (BID ALTERNATE SCHEDULE)	\$
Schedule E (BID ALTERNATE SCHEDULE)	\$
Total of Bid Alternates (Subtotal of Items A9 and C5)	\$
<b>TOTAL*</b>	<b>\$</b>

*\*Basis of selection will be the sum total of the Base Bid Schedule, Bid Alternate Schedules, and Bid Alternates. Refer to the Instructions to Bidders Section C-200 for evaluation of bids.*

**ARTICLE 4—TIME OF COMPLETION**

- 4.01 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.
- 4.02 Bidder accepts the provisions of the Agreement as to liquidated damages and payments to Owner for Unscheduled Employment of the Engineer.

**ARTICLE 5—BIDDER’S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA**

5.01 *Bid Acceptance Period*

- A. 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.

5.02 *Instructions to Bidders*

- A. Bidder accepts all of the terms and conditions of the Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

5.03 *Receipt of Addenda*

- A. Bidder hereby acknowledges receipt of the following Addenda:

<b>Addendum Number</b>	<b>Addendum Date</b>

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#### 5.04 *Assignment of Contract*

- A. Bidder acknowledges the provisions of the Agreement as to the assignment of the specified contract for procurement of goods and special services.

### **ARTICLE 6—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS**

#### 6.01 *Bidder’s Representations*

- A. In submitting this Bid, Bidder represents the following:
  - 1. Bidder has examined and carefully studied the Bidding Documents, including Addenda and any data and reference items identified in the Bidding Documents.
  - 2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
  - 3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work, including all American Iron and Steel requirements.
  - 4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions and Special Provisions, with respect to the Technical Data in such reports and drawings.
  - 5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions and Special Provisions, with respect to Technical Data in such reports and drawings.
  - 6. 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 the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder’s (Contractor’s) safety precautions and programs.
  - 7. Based on the information and observations referred to in the preceding paragraph, Bidder 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.
  - 8. 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.
  - 9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.

10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

#### 6.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. 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.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this paragraph:
  - a. 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.
  - b. 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.
  - c. 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.
  - d. 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.

#### 6.03 *Federal Certifications*

- A. For convenience the "Compliance Statement & Certification of Non-Segregated Facilities" (Form RD 400-6), "Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions" (Form AD-1048), and RD Instruction 1940-Q, Exhibit A-1, "Certification for Contracts, Grants, and Loans" are included as part of this bid form (Note: Lower Tier, means lower tier to the owner). By signing the bid form, the bidder represents that (s)he is also signing the below documents, as they apply, depending on the bid amount.
1. If the bid amount exceeds \$10,000, then Compliance Statement (RD 400-6) applies (8.02.B.1 of this part);
  2. If the bid amount exceeds \$25,000, then Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion - Lower Tier Covered Transactions (AD-1048) also applies (8.02.B.2 of this part);

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3. If the bid amount exceeds \$100,000, then RD Instruction 1940-Q, Exhibit A-1, Certification for Contracts, Grants, and Loans also applies (8.02.B.3 of this part).

B. Compliance Statement

USDA Form Approved, COMPLIANCE STATEMENT, Form RD 400-6

This statement relates to a proposed contract with { }, who expects to finance the contract with assistance from the Rural Utilities Service (RUS) or their successor agencies, United States Department of Agriculture (whether by a loan, grant, loan insurance, guarantee, or other form of financial assistance). I am the undersigned bidder or prospective contractor, I represent that:

- i. I ☐ have, ☐ have not, participated in a previous contract or subcontract subject to Executive Order No. 11246 (regarding equal employment opportunity), as amended by Executive Order No. 13672, 79 Fed. Reg. 42971 (July 21, 2014) or a preceding similar Executive Order.
- ii. If I have participated in such a contract or subcontract, I ☐ have, ☐ have not, filed all compliance reports that have been required to file in connection with the contract or subcontract.
- iii. If the proposed contract is for \$50,000 or more and I have 50 or more employees, I also represent that: I ☐ have, ☐ have not previously had contracts subject to the written affirmative action programs requirements of the Secretary of Labor.
- iv. If I have participated in such a contract or subcontract, I ☐ have, ☐ have not developed and placed on file at each establishment affirmative action programs as required by the rules and regulations of the Secretary of Labor.

I understand that if I have failed to file any compliance reports that have been required of me, I am not eligible and will not be eligible to have my bid considered or to enter into the proposed contract unless and until I make an arrangement regarding such reports that is satisfactory to either the RHS, RBS or RUS, or to the office where the reports are required to be filed.

I also certify that I do not maintain or provide for my employees any segregated facilities at any of my establishments, and that I do not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I certify further that I will not maintain or provide for my employees any segregated facilities at any of my establishments, and that I will not permit my employees to perform their services at any location, under my control, where segregated facilities are maintained. I agree that a breach of this certification is a violation of the Equal Opportunity clause in my contract. As used in this certification, the term "segregated facilities" means any waiting rooms, work areas, restrooms and wash rooms, restaurants and other eating areas time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees which are segregated by explicit directive or

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are in fact segregated on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin, because of habit, local custom, or otherwise. I further agree that (except where I have obtained identical certifications for proposed subcontractors for specific time periods) I will obtain identical certifications from proposed subcontractors prior to the award of subcontracts exceeding \$10,000 which are not exempt from the provisions of the Equal Opportunity clause; that I will retain such certifications in my files; and that I will forward the following notice to such proposed subcontractors (except where the proposed subcontractors have submitted identical certifications for specific time periods).

#### NOTICE TO PROSPECTIVE SUBCONTRACTORS OF REQUIREMENTS FOR CERTIFICATIONS OF NON-SEGREGATED FACILITIES

A certification of Non-segregated Facilities, as required by the May 9, 1967, order (32F.R. 7439, May 19, 1967) on Elimination of Segregated Facilities, by the Secretary of Labor, must be submitted prior to the award of a subcontract exceeding \$10,000 which is not exempt from the provisions of the Equal Opportunity clause. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e. quarterly, semiannually, or annually).

NOTE: The penalty for making false statements in offers is prescribed in 18 U.S.C. 1001.

1. Certification Regarding Debarment, Suspension, Ineligibility and Voluntary Exclusion – Lower Tier Covered Transactions

#### U.S. DEPARTMENT OF AGRICULTURE

CERTIFICATION REGARDING DEBARMENT, SUSPENSION, INELIGIBILITY  
AND VOLUNTARY EXCLUSION - LOWER TIER COVERED TRANSACTIONS  
USDA Form AD-1048

The following statement is made in accordance with the Privacy Act of 1974 (5 U.S.C. § 552(a), as amended). This certification is required by the regulations implementing Executive Order 12549, Debarment and Suspension, and 2 C.F.R. §§ 180.300, 180.355, Participants' responsibilities. The regulations were amended and published on August 31, 2005, in 70 Fed. Reg. 51865-51880. Copies of the regulations may be obtained by contacting the Department of Agriculture agency offering the proposed covered transaction. According to the Paperwork Reduction Act of 1995 an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0505-0027. The time required to complete this information collection is estimated to average 15 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. The provisions of appropriate criminal and civil fraud privacy, and other statutes may be applicable to the information provided.

Before signing the bid form, read instructions for Form AD-1048, available for download at:

[https://www.ocio.usda.gov/sites/default/files/docs/2012/AD1048\\_LowerTierCoveredTransactions\\_final.pdf](https://www.ocio.usda.gov/sites/default/files/docs/2012/AD1048_LowerTierCoveredTransactions_final.pdf)

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(1) The prospective lower tier participant certifies, by submission of this proposal, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in this transaction by any Federal department or agency.

(2) Where the prospective lower tier participant is unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this proposal.

2. Certification for Contracts, Grants and Loans

<p style="text-align: center;">CERTIFICATION FOR CONTRACTS, GRANTS AND LOANS RD Instruction 1940-Q, Exhibit A-1</p>
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The bidder certifies, to the best of his or her knowledge and belief, that:

- 1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant or Federal loan, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant or loan.
- 2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant or loan, the undersigned shall complete and submit Standard Form - LLL, "Disclosure of Lobbying Activities," in accordance with its instructions.
- 3) The undersigned shall require that the language of this certification be included in the award documents for all sub awards at all tiers (including contracts, subcontracts, and sub grants under grants and loans) and that all sub recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

BIDDER hereby submits this Bid as set forth above:

Bidder:

\_\_\_\_\_  
*(typed or printed name of organization)*

By:

\_\_\_\_\_  
*(individual's signature)*

Name:

\_\_\_\_\_  
*(typed or printed)*

Title:

\_\_\_\_\_  
*(typed or printed)*

Date:

\_\_\_\_\_  
*(typed or printed)*

*If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.*

Attest:

\_\_\_\_\_  
*(individual's signature)*

Name:

\_\_\_\_\_  
*(typed or printed)*

Title:

\_\_\_\_\_  
*(typed or printed)*

Date:

\_\_\_\_\_  
*(typed or printed)*

Address for giving notices:

\_\_\_\_\_  
\_\_\_\_\_

Bidder's Contact:

Name:

\_\_\_\_\_  
*(typed or printed)*

Title:

\_\_\_\_\_  
*(typed or printed)*

Phone:

Email:

Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Bidder's Contractor License No.: (if applicable)

\_\_\_\_\_

**END OF SECTION**

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## BID BOND (PENAL SUM FORM)

<b>Bidder</b> Name: <b>[Full formal name of Bidder]</b> Address <i>(principal place of business)</i> : <b>[Address of Bidder's principal place of business]</b>	<b>Surety</b> Name: <b>[Full formal name of Surety]</b> Address <i>(principal place of business)</i> : <b>[Address of Surety's principal place of business]</b>
<b>Owner</b> Name: <b>[Full formal name of Owner]</b> Address <i>(principal place of business)</i> : <b>[Address of Owner's principal place of business]</b>	<b>Bid</b> Project <i>(name and location)</i> : <b>[Owner project/contract name, and location of the project]</b>  Bid Due Date: <b>[Enter date bid is due]</b>
<b>Bond</b> Penal Sum: <b>[Amount]</b> Date of Bond: <b>[Date]</b>	
Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.	
Bidder	Surety
_____ <i>(Full formal name of Bidder)</i>	_____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature) (Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<i>Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.</i>	



1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs 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 will 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 does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will 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 will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must 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 Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will 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 will 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 governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

**SECTION 00430-A**  
**SUBCONTRACTOR LISTING**

The following information must be submitted with the prime contractors bid. Failure to provide this form within the allotted time may disqualify potential bidders as non-responsive. Include all subcontractors providing Work exceeding \$50,000.

[illegible]

**SECTION 00430-B  
SUPPLIER LISTING**

The following information must be submitted with the prime contractors bid. Failure to provide this form within the allotted time may disqualify potential bidders as non-responsive. Include all suppliers providing major items and/or materials exceeding \$50,000.

Equipment Supplied	Supplier	Manufacturer	Model	Equipment Cost
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$
Other:				\$
				\$
				\$
				\$
				\$
				\$
				\$
				\$

## ARTICLE 1—GENERAL INFORMATION

### 1.01 Provide contact information for the Business:

Legal Name of Business:			
Corporate Office			
Name:		Phone number:	
Title:		Email address:	
Business address of corporate office:			
Local Office			
Name:		Phone number:	
Title:		Email address:	
Business address of local office:			

### 1.02 Provide information on the Business's organizational structure:

Form of Business:	<input type="checkbox"/> Sole Proprietorship <input type="checkbox"/> Partnership <input type="checkbox"/> Corporation		
<input type="checkbox"/> Limited Liability Company <input type="checkbox"/> Joint Venture comprised of the following companies:			
1.			
2.			
3.			
Provide a separate Qualification Statement for each Joint Venturer.			
Date Business was formed:		State in which Business was formed:	
Is this Business authorized to operate in the Project location?		<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Pending	

### 1.03 Identify all businesses that own Business in whole or in part (25% or greater), or that are wholly or partly (25% or greater) owned by Business:

Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			
Name of business:		Affiliation:	
Address:			

- 1.04 Provide information regarding the Business's officers, partners, and limits of authority.

Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	
Authorized to sign contracts:	<input type="checkbox"/> Yes <input type="checkbox"/> No	Limit of Authority:	\$
Name:		Title:	

## ARTICLE 2—LICENSING

- 2.01 Provide information regarding licensure for Business:

Name of License:			
Licensing Agency:			
License No:		Expiration Date:	
Name of License:			
Licensing Agency:			
License No:		Expiration Date:	

## ARTICLE 3—DIVERSE BUSINESS CERTIFICATIONS

- 3.01 Provide information regarding Business's Diverse Business Certification, if any. Provide evidence of current certification.

Certification	Certifying Agency	Certification Date
<input type="checkbox"/> Disadvantaged Business Enterprise		
<input type="checkbox"/> Minority Business Enterprise		
<input type="checkbox"/> Woman-Owned Business Enterprise		
<input type="checkbox"/> Small Business Enterprise		
<input type="checkbox"/> Disabled Business Enterprise		
<input type="checkbox"/> Veteran-Owned Business Enterprise		
<input type="checkbox"/> Service-Disabled Veteran-Owned Business		
<input type="checkbox"/> HUBZone Business (Historically Underutilized) Business		
<input type="checkbox"/> Other		
<input type="checkbox"/> None		

## ARTICLE 4—SAFETY

- 4.01 Provide information regarding Business's safety organization and safety performance.

Name of Business's Safety Officer:		
Safety Certifications		
Certification Name	Issuing Agency	Expiration

- 4.02 Provide Worker's Compensation Insurance Experience Modification Rate (EMR), Total Recordable Frequency Rate (TRFR) for incidents, and Total Number of Recorded Manhours (MH) for the last 3 years and the EMR, TRFR, and MH history for the last 3 years of any proposed Subcontractor(s) that will provide Work valued at 10% or more of the Contract Price. Provide documentation of the EMR history for Business and Subcontractor(s).

Year									
Company	EMR	TRFR	MH	EMR	TRFR	MH	EMR	TRFR	MH

## ARTICLE 5—FINANCIAL

- 5.01 Provide information regarding the Business's financial stability. Provide the most recent audited financial statement, and if such audited financial statement is not current, also provide the most current financial statement.

Financial Institution:		
Business address:		
Date of Business's most recent financial statement:		<input type="checkbox"/> Attached
Date of Business's most recent audited financial statement:		<input type="checkbox"/> Attached
Financial indicators from the most recent financial statement		
Contractor's Current Ratio (Current Assets ÷ Current Liabilities)		
Contractor's Quick Ratio ((Cash and Cash Equivalents + Accounts Receivable + Short Term Investments) ÷ Current Liabilities)		

## ARTICLE 6—SURETY INFORMATION

- 6.01 Provide information regarding the surety company that will issue required bonds on behalf of the Business, including but not limited to performance and payment bonds.

Surety Name:			
Surety is a corporation organized and existing under the laws of the state of:			
Is surety authorized to provide surety bonds in the Project location?	<input type="checkbox"/> Yes <input type="checkbox"/> No		
Is surety listed in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" published in Department Circular 570 (as amended) by the Bureau of the Fiscal Service, U.S. Department of the Treasury? <input type="checkbox"/> Yes <input type="checkbox"/> No			
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

## ARTICLE 7—INSURANCE

- 7.01 Provide information regarding Business's insurance company(s), including but not limited to its Commercial General Liability carrier. Provide information for each provider.

Name of insurance provider, and type of policy (CLE, auto, etc.):			
Insurance Provider		Type of Policy (Coverage Provided)	
Are providers licensed or authorized to issue policies in the Project location?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Does provider have an A.M. Best Rating of A-VII or better?		<input type="checkbox"/> Yes <input type="checkbox"/> No	
Mailing Address (principal place of business):			
Physical Address (principal place of business):			
Phone (main):		Phone (claims):	

## ARTICLE 8—CONSTRUCTION EXPERIENCE

8.01 Provide information that will identify the overall size and capacity of the Business.

Average number of current full-time employees:	
Estimate of revenue for the current year:	
Estimate of revenue for the previous year:	

8.02 Provide information regarding the Business's previous contracting experience.

Years of experience with projects like the proposed project:				
As a general contractor:		As a joint venturer:		
Has Business, or a predecessor in interest, or an affiliate identified in Paragraph 1.03:				
Been disqualified as a bidder by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Been barred from contracting by any local, state, or federal agency within the last 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Been released from a bid in the past 5 years? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Defaulted on a project or failed to complete any contract awarded to it? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Refused to construct or refused to provide materials defined in the contract documents or in a change order? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Been a party to any currently pending litigation or arbitration? <input type="checkbox"/> Yes <input type="checkbox"/> No				
Provide full details in a separate attachment if the response to any of these questions is Yes.				

8.03 List all projects currently under contract in Schedule A and provide indicated information.

8.04 List a minimum of three and a maximum of six projects completed in the last 5 years in Schedule B and provide indicated information to demonstrate the Business's experience with projects similar in type and cost of construction.

8.05 In Schedule C, provide information on key individuals whom Business intends to assign to the Project. Provide resumes for those individuals included in Schedule C. Key individuals include the Project Manager, Project Superintendent, Quality Manager, and Safety Manager. Resumes may be provided for Business's key leaders as well.

## ARTICLE 9—REQUIRED ATTACHMENTS

9.01 Provide the following information with the Statement of Qualifications:

- A. If Business is a Joint Venture, separate Qualifications Statements for each Joint Venturer, as required in Paragraph 1.02.
- B. Diverse Business Certifications if required by Paragraph 3.01.
- C. Certification of Business's safety performance if required by Paragraph 4.02.
- D. Financial statements as required by Paragraph 5.01.



- E. Attachments providing additional information as required by Paragraph 8.02.
- F. Schedule A (Current Projects) as required by Paragraph 8.03.
- G. Schedule B (Previous Experience with Similar Projects) as required by Paragraph 8.04.
- H. Schedule C (Key Individuals) and resumes for the key individuals listed, as required by Paragraph 8.05.
- I. Additional items as pertinent.

This Statement of Qualifications is offered by:

Business:

\_\_\_\_\_  
*(typed or printed name of organization)*

By:

\_\_\_\_\_  
*(individual's signature)*

Name:

\_\_\_\_\_  
*(typed or printed)*

Title:

\_\_\_\_\_  
*(typed or printed)*

Date:

\_\_\_\_\_  
*(date signed)*

*(If Business is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)*

Attest:

\_\_\_\_\_  
*(individual's signature)*

Name:

\_\_\_\_\_  
*(typed or printed)*

Title:

\_\_\_\_\_  
*(typed or printed)*

Address for giving notices:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Designated Representative:

Name:

\_\_\_\_\_  
*(typed or printed)*

Title:

\_\_\_\_\_  
*(typed or printed)*

Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Phone:

\_\_\_\_\_

Email:

\_\_\_\_\_

**Schedule A—Current Projects**

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

**Schedule B—Previous Experience with Similar Projects**

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

**Schedule B—Previous Experience with Similar Projects**

Name of Organization					
Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

Project Owner			Project Name		
General Description of Project					
Project Cost			Date Project		
Key Project Personnel	Project Manager	Project Superintendent	Safety Manager	Quality Control Manager	
Name					
Reference Contact Information (listing names indicates approval to contacting the names individuals as a reference)					
	Name	Title/Position	Organization	Telephone	Email
Owner					
Designer					
Construction Manager					

**Schedule C—Key Individuals**

<b>Project Manager</b>			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
<b>Project Superintendent</b>			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

<b>Safety Manager</b>			
Name of individual			
Years of experience as project manager			
Years of experience with this organization			
Number of similar projects as project manager			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	
<b>Quality Control Manager</b>			
Name of individual			
Years of experience as project superintendent			
Years of experience with this organization			
Number of similar projects as project superintendent			
Number of similar projects in other positions			
Current Project Assignments			
Name of assignment		Percent of time used for this project	Estimated project completion date
Reference Contact Information (listing names indicates approval to contact named individuals as a reference)			
Name		Name	
Title/Position		Title/Position	
Organization		Organization	
Telephone		Telephone	
Email		Email	
Project		Project	
Candidate's role on project		Candidate's role on project	

## SECTION 00500

### AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT

This Agreement is by and between Bonner County, Idaho ("Owner") and \_\_\_\_\_ ("Contractor").

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

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: Improvements to the Colburn Facility, including but not limited to site/yard improvements, new buildings, electrical systems, and mechanical and plumbing systems.

#### ARTICLE 2 – THE PROJECT

- 2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Bonner County Solid Waste Colburn Facility Improvements.

#### ARTICLE 3 – ENGINEER

- 3.01 The Owner has retained Great West Engineering ("Engineer") to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.
- 3.02 The part of the Project that pertains to the Work has been designed by **Great West Engineering.**

#### 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: Days*

- A. The Work will be substantially complete within 360 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 420 calendar days after the date when the Contract Times commence to run.

##### 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 Contract Times, as duly modified. The parties also

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Section 00500 - Agreement between Owner and Contractor for Construction Contract

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).



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 \$1,000 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified 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 \$1,000 for each day that expires after such time until the Work is completed and ready for final payment.
  - ~~3. *Milestones:* Contractor shall pay Owner \$\_\_\_\_\_ for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.~~
  4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.
- C. DELETED

#### 4.04 Special Damages

- A. Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
1. Damages for (2) in the above paragraph will be incurred based on the following hourly rates:

Straight Time	
Project Manager	\$211.00/Hour
Project Engineer	\$187.00/Hour
Resident Project Representative (RPR)	\$141.00/Hour
RPR Overtime Rate	\$212.00/Hour
Project Administrator	\$138.00/Hour
Clerical	\$89.00/Hour
Mileage	\$0.85/Mile

- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.
- C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

## 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:~~ an amount equal to the sum of the established unit prices for each bid item from the bid form multiplied by the actual quantity of the respective bid item constructed and accepted.

~~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).~~

Unit Price Work					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Extended Price
				\$	\$
				\$	\$
				\$	\$
				\$	\$
				\$	\$
Total of all Extended Prices for Unit Price Work (subject to final adjustment based on actual quantities)					\$

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 and Unit Price Work (subject to final Unit Price adjustment)~~  
~~\$\_\_\_\_\_~~

D. For all Work, at the prices stated in Contractor's Bid, attached hereto as an exhibit.

## 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 the basis of Contractor's Applications for Payment on or about the 14th day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, 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-percent (95%) of the value of the Work completed (with the balance being retainage).
    - b. Ninety five-percent (95%) of cost of materials and equipment not incorporated in the Work (with the balance being retainage).
- B. Upon Substantial Completion of the entire construction to be provided under the construction Contract Documents, Owner shall pay an amount sufficient to increase total payments to Contractor to one hundred percent (100%) of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less two hundred percent (200%) of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

### 6.03 *Final Payment*

- A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

### 6.04 *Consent of Surety*

- A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

### 6.05 *Interest*

- A. All amounts not paid when due will bear interest at the ~~rate of percent~~ maximum rate per annum Idaho Code 63-3045.

## ARTICLE 7 – CONTRACTOR'S DOCUMENTS

### 7.01 Contents

- A. The Contract Documents consist of the following:
1. This Agreement (pages 1 to 10, inclusive).
  2. Invitation to Bid (pages 1 to 2, inclusive).
  3. Instructions to Bidders (pages 1 to 18, inclusive).
  4. Bid Form (pages 1 to 14, inclusive).
  5. Bonds:
    - a. Performance Bond (together with power of attorney) (pages 1 to 4, inclusive).
    - b. Payment Bond (together with power of attorney) (pages 1 to 4, inclusive).
  6. General Conditions (pages 1 to 70, inclusive).
  7. Supplementary Conditions (pages 1 to 39, inclusive, plus attached Exhibits).
  8. Special Provisions (pages 1 to 11, inclusive).
  - ~~9. Funding Agency Special Provisions for Montana Public Facility Projects (pages 1 to \_\_\_\_\_, inclusive).~~
  - ~~10. Federal Prevailing Wage Rates (pages 1 to \_\_\_\_\_, inclusive).~~
  11. Specifications as listed in the table of contents of the project manual (copy of list attached).
  12. Drawings (not attached but incorporated by reference) ~~consisting of \_\_\_\_\_ sheets,~~ with each sheet bearing the following general title: Bonner County Solid Waste Colburn Facility Improvements.
  13. Qualifications Statement and Listings:
    - a. Qualifications Statement (pages 1 to 7, inclusive plus Schedules A, B, and C forms).
    - b. Subcontractor Listing (pages 1 to 1, inclusive).
    - c. Supplier Listing (pages 1 to 1, inclusive).
  14. Addenda (numbers \_\_\_\_\_ to \_\_\_\_\_ inclusive).
  15. Exhibits to this Agreement (enumerated as follows):
    - a. Notice of Award (pages 1 to 1, inclusive).
    - b. Application for Payment (pages 1 to 4, inclusive).
    - c. Notice to Proceed (pages 1 to 1, inclusive).
    - d. Work Change Directive (pages 1 to 1, inclusive).
    - e. Change Order (pages 1 of 1, inclusive).
    - f. Field Order (pages 1 of 1, inclusive).
    - g. Substantial Completion (pages 1 of 1, inclusive).

- h. Notice of Acceptability of Work (pages 1 of 1, inclusive).
- 16. 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.~~
  - e. Warranty Bond, if any.
- 17. Permits – Approved and Pending.
- 18. The Idaho Standards for Public Works Construction 2020 Edition, collectively referred to as ISPWC, as may be modified by above Contract Documents. (The ISPWC is not attached to the Agreement).
- B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 7.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the ~~Contract~~ General Conditions.

## ARTICLE 8 – REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

### 8.01 *Contractor's Representations*

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
  - 1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
  - 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
  - 3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
  - 4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
  - 5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.

6. 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 Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
7. 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.
8. 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.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. 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.

#### 8.02 *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 8.02:
  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.

### 8.03 *Standard General Conditions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), 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.

## ARTICLE 9 – MISCELLANEOUS

- ~~9.01 The contract between Owner as “Buyer” and as “Seller” for procurement of goods and special services (“Procurement Contract”) for [ ] will be assigned to Contractor by Owner, and Contractor will accept such assignment. A form documenting the assignment is attached as an exhibit to this Agreement.~~
- ~~9.02 This assignment will occur on [the Effective Date of the Agreement] and will relieve the Owner as Buyer from all further obligations and liabilities under the Procurement Contract. Contractor, as Buyer (Contractor/Assignee) following assignment, will assume full responsibility to Owner for the performance of obligations by Seller, which will be Contractor’s Subcontractor or Supplier. Notwithstanding this assignment, all performance guarantees and warranties required by the Procurement Contract will continue to run for the benefit of the Owner and, in addition, for the benefit of the Contractor. Except as noted in the Procurement Contract, all rights, duties, and obligations of Engineer to Buyer and Seller under the Procurement Contract will cease upon assignment.~~
- ~~9.03 A copy of the assigned Procurement Contract is attached.~~

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:

\_\_\_\_\_  
(typed or printed name of organization)

By: \_\_\_\_\_  
(individual's signature)

Date: \_\_\_\_\_  
(date signed)

Name: \_\_\_\_\_  
(typed or printed)

Title: \_\_\_\_\_  
(typed or printed)

Attest: \_\_\_\_\_  
(individual's signature)

Title: \_\_\_\_\_  
(typed or printed)

Address for giving notices:

\_\_\_\_\_  
\_\_\_\_\_

Designated Representative:

Name: \_\_\_\_\_  
(typed or printed)

Title: \_\_\_\_\_  
(typed or printed)

Address:

\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

(If [Type of Entity] is a corporation, attach evidence of authority to sign. If [Type of Entity] is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

Contractor:

\_\_\_\_\_  
(typed or printed name of organization)

By: \_\_\_\_\_  
(individual's signature)

Date: \_\_\_\_\_  
(date signed)

Name: \_\_\_\_\_  
(typed or printed)

Title: \_\_\_\_\_  
(typed or printed)

(If [Type of Entity] is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest: \_\_\_\_\_  
(individual's signature)

Title: \_\_\_\_\_  
(typed or printed)

Address for giving notices:

\_\_\_\_\_  
\_\_\_\_\_

Designated Representative:

Name: \_\_\_\_\_  
(typed or printed)

Title: \_\_\_\_\_  
(typed or printed)

Address:

\_\_\_\_\_  
\_\_\_\_\_

Phone: \_\_\_\_\_

Email: \_\_\_\_\_

License No.: \_\_\_\_\_  
(where applicable)

State: \_\_\_\_\_



**CERTIFICATE OF OWNER'S ATTORNEY AND AGENCY CONCURRENCE**

**CERTIFICATE OF OWNER'S ATTORNEY**

Project Name: \_\_\_\_\_

Contractor Name: \_\_\_\_\_

I, the undersigned, \_\_\_\_\_, the duly authorized and acting legal representative \_\_\_\_\_, do hereby certify as follows: I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

\_\_\_\_\_  
Name Date

**AGENCY CONCURRENCE**

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

\_\_\_\_\_  
Agency Representative Date

\_\_\_\_\_  
Name

**END OF SECTION**

## NOTICE OF AWARD

Date of Issuance:

Owner: Bonner County, Idaho

Owner's Project No.: SW023-2023

Engineer: Great West Engineering

Engineer's Project No.: 4-21115

Project: Bonner County Solid Waste Colburn Facility Improvements

Contract Name: Bonner County Solid Waste Colburn Facility Improvements

Bidder: \_\_\_\_\_

Bidder's Address: \_\_\_\_\_

You are notified that Owner has accepted your Bid dated \_\_\_\_\_ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

\_\_\_\_\_

The Contract Price of the awarded Contract is \$\_\_\_\_\_. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

[ 3 ] unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

☐ Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner [ 3 ] counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner:

By (signature): \_\_\_\_\_

Name (printed): \_\_\_\_\_

Title: \_\_\_\_\_

Copy: Engineer

## NOTICE TO PROCEED

Owner: Bonner County, Idaho Owner's Project No.: SW023-2023  
Engineer: Great West Engineering Engineer's Project No.: 4-21115  
Contractor: \_\_\_\_\_ Contractor's Project No.: \_\_\_\_\_  
Project: Bonner County Solid Waste Colburn Facility Improvements  
Contract Name: Bonner County Solid Waste Colburn Facility Improvements  
Effective Date of Contract: \_\_\_\_\_

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on \_\_\_\_\_ pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement:

The number of days to achieve Substantial Completion is \_\_\_\_ from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of \_\_\_\_\_; and the number of days to achieve readiness for final payment is \_\_\_\_ from the commencement date of the Contract Times, resulting in a date for readiness for final payment of \_\_\_\_.

Before starting any Work at the Site, Contractor must comply with the following:

Owner: \_\_\_\_\_  
By (signature): \_\_\_\_\_  
Name (printed): \_\_\_\_\_  
Title: \_\_\_\_\_  
Date Issued: \_\_\_\_\_  
Copy: Engineer

## PERFORMANCE BOND

<b>Contractor</b> Name: _____ Address <i>(principal place of business)</i> : _____	<b>Surety</b> Name: _____ Address <i>(principal place of business)</i> : _____
<b>Owner</b> Name: <b>Bonner County</b> Mailing address <i>(principal place of business)</i> : <b>Bonner County Commissioner's Office</b> <b>1500 HWY 2, Suite 308</b> <b>Sandpoint, ID 83864</b>	<b>Contract</b> Description <i>(name and location)</i> : _____  Contract Price: _____ Effective Date of Contract: _____
<b>Bond</b> Bond Amount: _____ Date of Bond: _____ <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 16	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
_____ <i>(Full formal name of Contractor)</i>	_____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <div style="text-align: center;"><i>(Signature)</i></div>	By: _____ <div style="text-align: center;"><i>(Signature)(Attach Power of Attorney)</i></div>
Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>	Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>
Title: _____	Title: _____
Attest: _____ <div style="text-align: center;"><i>(Signature)</i></div>	Attest: _____ <div style="text-align: center;"><i>(Signature)</i></div>
Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>	Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>
Title: _____	Title: _____
<i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i>	

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 will 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 may 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 will 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 does 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 does 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 will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will 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 will not be reduced or set off on account of any such unrelated obligations. No right of action will 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 must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must 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 will be applicable.
- 12. Notice to the Surety, the Owner, or the Contractor must 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 will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will 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 will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows:

## PAYMENT BOND

<b>Contractor</b> Name: Address <i>(principal place of business)</i> :	<b>Surety</b> Name: Address <i>(principal place of business)</i> :
<b>Owner</b> Name: <b>Bonner County</b> Mailing address <i>(principal place of business)</i> : <b>Bonner County Commissioner's Office</b> <b>1500 HWY 2, Suite 308</b> <b>Sandpoint, ID 83864</b>	<b>Contract</b> Description <i>(name and location)</i> :  Contract Price: Effective Date of Contract:
<b>Bond</b> Bond Amount: Date of Bond: <i>(Date of Bond cannot be earlier than Effective Date of Contract)</i> Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 18	
Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.	
Contractor as Principal	Surety
<i>(Full formal name of Contractor)</i>	<i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <div style="text-align: center;"><i>(Signature)</i></div>	By: _____ <div style="text-align: center;"><i>(Signature)(Attach Power of Attorney)</i></div>
Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>	Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>
Title: _____	Title: _____
Attest: _____ <div style="text-align: center;"><i>(Signature)</i></div>	Attest: _____ <div style="text-align: center;"><i>(Signature)</i></div>
Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>	Name: _____ <div style="text-align: center;"><i>(Printed or typed)</i></div>
Title: _____	Title: _____
<i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i>	



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 will 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 will 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 will 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 will 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 will 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 will 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 satisfying 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 will 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 will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will 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 will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will 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:
    - 16.1.1. The name of the Claimant;
    - 16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
    - 16.1.3. 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;
    - 16.1.4. A brief description of the labor, materials, or equipment furnished;

- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
  - 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
  - 16.1.7. The total amount of previous payments received by the Claimant; and
  - 16.1.8. 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 is 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 will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
18. Modifications to this Bond are as follows:

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

## APPLICATION FOR PAYMENT

Prepared By



Endorsed By



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# **GUIDELINES FOR THE INTENDED USE OF EJCDC C-620, APPLICATION FOR PAYMENT**

## **1.0 PURPOSE AND INTENDED USE OF THE DOCUMENT**

The Application for Payment is used to facilitate periodic progress payments to the Contractor for Work completed and for stored materials and equipment (referred to in this document as "Stored Materials").

For additional information regarding the Application for Payment, see EJCDC® C-700, Standard General Conditions of the Construction Contract (2018), Paragraph 15.01, and EJCDC® C-001, Commentary on the 2018 EJCDC Construction Documents (2018).

## **2.0 APPLICATION FOR PAYMENT OVERVIEW**

This document was prepared in Microsoft Excel due to the number of calculations involved in the preparation of the Application for Payment. The application consists of a Summary worksheet, and 3 supporting worksheets: Lump Sum worksheet, Unit Price worksheet, and Stored Materials worksheet.

- 2.1 *Summary Worksheet* — calculates the amount to be paid to the Contractor at the end of each Application for Payment period. This calculation imports numbers from the supporting worksheets to determine the value of the Work completed and Stored Materials, calculate retainage, and deduct amounts previously paid to determine the amount the Contractor should be paid for the current application period. Application periods are typically one month; however these periods may be extended when Contractor's efforts do not result in the billable completion of Work or storage of materials and equipment during the payment period.
- 2.2 *Lump Sum Worksheet* — calculates the total value for completed Work for which compensation is paid on a Lump Sum basis. The schedule of values included in this worksheet reflects a breakdown of lump sum Work items to which Contractor and Engineer have agreed, pursuant to Article 2 of the General Conditions. Costs for Stored Materials associated with lump sum items are included on this worksheet to calculate the total value for completed lump sum Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for materials currently stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.
- 2.3 *Unit Price Worksheet* — calculates the total value for completed Work for which compensation is paid on a Unit Price basis. The schedule of values included in this spreadsheet is typically a tabulation of Unit Price items from the Agreement. Costs for Stored Materials associated with unit price items are included in this worksheet to calculate the total value for completed Unit Price Work and associated Stored Materials. This total is exported to the Summary worksheet. Separate totals for Work Completed and for Materials Currently Stored are also exported to the Summary worksheet for use in calculating the amount of retainage to be held for each.

- 2.4 *Stored Materials Worksheet* — calculates the total value for materials and equipment that have been purchased and are being stored until they are incorporated into the Work. This worksheet adds materials and equipment to the worksheet as they are brought to the site and stored; such Stored Materials are then deducted from the Stored Materials worksheet total as they are incorporated into the Work, providing a running net value for the materials and equipment remaining in storage. The values of Stored Materials must be manually added to the Lump Sum or Unit Price line items. These do not automatically update when changes are made. The amount of materials remaining in storage is eligible for payment but must be tracked separately from Work completed since different retainage rates may apply to Work completed and Stored Materials.

### **3.0 Instructions for filling out the Payment Application form**

- 3.1 Project-specific information is to be entered in the top portion (header) of the Summary worksheet. This same information will automatically be copied to the other worksheets to complete the headers on all other worksheets.
- 3.2 Outside of the header, data can be entered in non-shaded cells when the sheet is protected. Cells shaded light blue contain equations that will automatically transfer data from other cells or make calculations to complete the worksheet. Altering any of these cells can result in errors in the Application for Payment. It is recommended that the worksheets be protected at all times unless alterations are deliberately being made to the Application for Payment form other than to enter data. See Paragraph 4.0 below for information on Protection of Worksheets.
- 3.3 Enter information regarding each item in the Lump Sum and/or Unit Price worksheets. For Lump Sum projects, each item should represent an item in the schedule of values prepared by the Contractor and approved by the Engineer/Owner, breaking down the Lump Sum amount into measurable components. For Unit Price contracts, use numbers from the Agreement as the schedule of values. Specific information on the data to be entered into each column may be seen by clicking on the header description for that column. Similar comments may be seen for cells in the "Totals" row that indicates how the number is calculated and where this number is exported to another part of the spreadsheet. See the Commentary for additional information.
- 3.4 The equations in the Summary worksheet use numbers imported from both the Lump Sum and Unit Price worksheets. Projects will typically either use the Lump Sum or the Unit Price worksheet, but some projects may use both. If one of the worksheets is not used, it should be hidden and not deleted. If it is deleted, Users will need to correct the equations in the Summary worksheet by unprotecting the worksheet and editing the equations. To hide a worksheet, right click on the worksheet tab at the bottom of the worksheet and select "Hide." To unhide a worksheet, right click on any worksheet tab and select "Unhide," and then select the worksheet to unhide and click "Okay." This same process may be used to hide these Guidelines for Use.

#### **4.0 Protection of Worksheets**

- 4.1 The cells in this Workbook that create the forms or contain equations have been coded to "lock" the cells that should not be altered. It is recommended that the Workbook be Protected (cells locked) at all times unless it is necessary to add or delete rows. Directions for adding and deleting rows are provided in the next section. Passwords can be used to lock the Protect / Unprotect settings on spreadsheets, however the worksheets in this workbook do not require a password.
- 4.2 To unprotect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Unprotect Sheet." To protect a worksheet, click on the "Review" menu tab at the top of Excel, then click "Protect Sheet." This will open a dialog box in which the User is allowed to select protection options. It is recommended that only the top two checkboxes for "Select Locked Cells" and "Select Unlocked Cells" be checked. This will reset the protection for the Worksheet.

#### **5.0 Adding and Deleting Rows**

- 5.1 A limited number of blank rows are provided in the Lump Sum, Unit Price, and Stored Material worksheets. Additional rows may be added to these worksheets by the User. The first step in this process is to unprotect the worksheet as previously discussed. After the sheet is unprotected, move with caution to prevent inadvertently deleting any cells that contain equations. To insert a row, right click in the row heading at the left of the spreadsheet and select "Insert." A new row will be inserted at the location where the cursor was placed in the row heading. If more than one new row is desired, left click and drag the cursor to include the desired number of rows, right click in the selected row headings and then select "Insert." It is important that the line immediately above the "Totals" row not be included in the rows selected. Doing so will require that equations in the "Totals" row be adjusted. When rows are inserted, Excel automatically adjusts the equations to include the new rows, unless the row directly above the "Totals" row is also selected.
- 5.2 After new rows are inserted, it is important to copy a line from one of the original rows so correct formatting and equations are copied into each new row. To do this, select the row to be copied by clicking the cell in Column A and dragging the cursor to the last column in the table. Then select "Copy" from the menu or type CTRL+C to copy the cells. Excel will show that this row has been copied by showing a moving dashed line around the cells that are to be copied. Then select the new rows into which the information is to be copied as before and select Paste from the menu or type CTRL+V.
- 5.3 To delete an unused row, right click in the row heading on the left of the spreadsheet for the row to be deleted and select "Delete." The selected row will be deleted. If more than one row is to be deleted, left click and drag the cursor to the desired number of rows to be deleted and then right click to open the menu and select "Delete." Unlike the admonition on adding new rows, it is okay to delete the row just above the "Totals" row.
- 5.4 After rows have been added or deleted, it is important reset the worksheet protection.



## **6.0 Saving Files**

This file is provided as a Microsoft® Excel Open XML workbook template (.xltx) to prevent this file from being inadvertently changed. When an application for payment is created for a specific project it should be saved as an Excel workbook (.xlsx) file. To do this, select Save As (F12), type in a new file name and select Excel Workbook (.xlsx) from the drop down Save As Type menu.

## **7.0 License Agreement**

This document is subject to the terms and conditions of the License Agreement, 2018 EJCDC® Construction Series Documents. A copy of the License Agreement was furnished at the time of purchase of this document, and is available for review at [www.ejcdc.org](http://www.ejcdc.org) and the websites of EJCDC's sponsoring organizations.

**Contractor's Application for Payment**

<b>Owner:</b> <u>Bonner County</u>	<b>Owner's Project No.:</b> <u>SW023-2023</u>
<b>Engineer:</b> <u>Great West Engineering</u>	<b>Engineer's Project No.:</b> <u>4-21115</u>
<b>Contractor:</b> _____	<b>Contractor's Project No.:</b> _____
<b>Project:</b> <u>Bonner County Solid Waste Colburn Facility Improvements</u>	
<b>Contract:</b> <u>Bonner County Solid Waste Colburn Facility Improvements</u>	
<b>Application No.:</b> _____ <b>Application Date:</b> _____	
<b>Application Period:</b> <b>From</b> _____ <b>to</b> _____	

1. Original Contract Price	\$	-
2. Net change by Change Orders	\$	-
3. Current Contract Price (Line 1 + Line 2)	\$	-
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	\$	-
5. Retainage		
a. _____ X \$ _____ Work Completed	\$	-
b. _____ X \$ _____ Stored Materials	\$	-
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. Gross Amount due this application	\$	-
9. 1% MT Gross Receipts Tax (1% x Line 8)		
10. Unscheduled Employment of the Engineer	\$	-
9. Balance to finish, including retainage (Line 3 - Line 4)	\$	-

**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.

<b>Contractor:</b> _____	
<b>Signature:</b> _____	<b>Date:</b> _____

<b>Recommended by Engineer</b>	<b>Approved by Owner</b>
<b>By:</b> _____	<b>By:</b> _____
<b>Title:</b> _____	<b>Title:</b> _____
<b>Date:</b> _____	<b>Date:</b> _____
<b>Approved by Funding Agency</b>	
<b>By:</b> _____	<b>By:</b> _____
<b>Title:</b> _____	<b>Title:</b> _____
<b>Date:</b> _____	<b>Date:</b> _____

**Progress Estimate - Lump Sum Work**

**Contractor's Application for Payment**

<b>Owner:</b>	Bonner County					<b>Owner's Project No.:</b>	SW023-2023	
<b>Engineer:</b>	Great West Engineering					<b>Engineer's Project No.:</b>	4-21115	
<b>Contractor:</b>						<b>Contractor's Project No.:</b>		
<b>Project:</b>	Bonner County Solid Waste Colburn Facility Improvements							
<b>Contract:</b>	Bonner County Solid Waste Colburn Facility Improvements							

<b>Application No.:</b>		<b>Application Period:</b>	<b>From</b>		<b>to</b>		<b>Application Date:</b>	
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A	B	C	D	E	F	G	H	I
Item No.	Description	Scheduled Value (\$)	Work Completed		Materials Currently Stored (not in D or E) (\$)	Work Completed and Materials Stored to Date (D + E + F) (\$)	% of Scheduled Value (G / C) (%)	Balance to Finish (C - G) (\$)
			(D + E) From Previous Application (\$)	This Period (\$)				
Original Contract								
			-			-		-
						-		-
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						-		-
Original Contract Totals		\$ -	\$ -	\$ -	\$ -	\$ -		\$ -

**Progress Estimate - Unit Price Work**

**Contractor's Application for Payment**

<b>Owner:</b>	Bonner County	<b>Owner's Project No.:</b>	SW023-2023
<b>Engineer:</b>	Great West Engineering	<b>Engineer's Project No.:</b>	4-21115
<b>Contractor:</b>		<b>Contractor's Project No.:</b>	
<b>Project:</b>	Bonner County Solid Waste Colburn Facility Improvements		
<b>Contract:</b>	Bonner County Solid Waste Colburn Facility Improvements		

Application No.:		Application Period:		From		to		Application Date:			
A	B	C	D	E	F	G	H	I	J	K	L
Bid Item No.	Description	Contract Information				Work Completed		Materials Currently Stored (not in G) (\$)	Work Completed and Materials Stored to Date (H + I) (\$)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) (\$)
		Item Quantity	Units	Unit Price (\$)	Value of Bid Item (C X E) (\$)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) (\$)				
Original Contract											
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### Contractor's Application for Payment

<b>Application No.:</b> _____	<b>Application Period:</b>	<b>From</b> _____	<b>to</b> _____	<b>Application Date:</b> _____
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[illegible]

## CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner: Bonner County, Idaho Owner's Project No.: SW023-2023  
Engineer: Great West Engineering Engineer's Project No.: 4-21115  
Contractor: Contractor's Project No.:  
Project: Bonner County Solid Waste Colburn Facility Improvements  
Contract Name: Bonner County Solid Waste Colburn Facility Improvements

This ☐ Preliminary ☐ Final Certificate of Substantial Completion applies to:

☐ All Work ☐ The following specified portions of the Work:

Date of Substantial Completion: \_\_\_\_\_

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and the failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: ☐ None ☐ As follows:

Amendments to Contractor's Responsibilities: ☐ None ☐ As follows:

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

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

Engineer

By (signature): \_\_\_\_\_

Name (printed): \_\_\_\_\_

Title: \_\_\_\_\_

## NOTICE OF ACCEPTABILITY OF WORK

Owner:	Bonner County, Idaho	Owner's Project No.:	SW023-2023
Engineer:	Great West Engineering	Engineer's Project No.:	4-21115
Contractor:		Contractor's Project No.:	
Project:	Bonner County Solid Waste Colburn Facility Improvements		
Contract Name:	Bonner County Solid Waste Colburn Facility Improvements		
Notice Date:	Effective Date of the Construction Contract:		

The Engineer hereby gives notice to the Owner and Contractor that Engineer recommends final payment to Contractor, and that the Work furnished and performed by Contractor under the Construction Contract is acceptable, expressly subject to the provisions of the Construction Contract's Contract Documents ("Contract Documents") and of the Agreement between Owner and Engineer for Professional Services dated \_\_\_\_\_ ("Owner-Engineer Agreement"). This Notice of Acceptability of Work (Notice) is made expressly subject to the following terms and conditions to which all who receive and rely on said Notice agree:

1. This Notice has been prepared with the skill and care ordinarily used by members of the engineering profession practicing under similar conditions at the same time and in the same locality.
2. This Notice reflects and is an expression of the Engineer's professional opinion.
3. This Notice has been prepared to the best of Engineer's knowledge, information, and belief as of the Notice Date.
4. This Notice is based entirely on and expressly limited by the scope of services Engineer has been employed by Owner to perform or furnish during construction of the Project (including observation of the Contractor's Work) under the Owner-Engineer Agreement, and applies only to facts that are within Engineer's knowledge or could reasonably have been ascertained by Engineer as a result of carrying out the responsibilities specifically assigned to Engineer under such Owner-Engineer Agreement.
5. This Notice is not a guarantee or warranty of Contractor's performance under the Construction Contract, an acceptance of Work that is not in accordance with the Contract Documents, including but not limited to defective Work discovered after final inspection, nor an assumption of responsibility for any failure of Contractor to furnish and perform the Work thereunder in accordance with the Contract Documents, or to otherwise comply with the Contract Documents or the terms of any special guarantees specified therein.
6. This Notice does not relieve Contractor of any surviving obligations under the Construction Contract, and is subject to Owner's reservations of rights with respect to completion and final payment.

Engineer

By (*signature*): \_\_\_\_\_

Name (*printed*): \_\_\_\_\_

Title: \_\_\_\_\_

**WORK CHANGE DIRECTIVE NO.: \_\_\_\_**

Owner: Bonner County, Idaho Owner's Project No.: SW023-2023  
Engineer: Great West Engineering Engineer's Project No.: 4-21115  
Contractor: Contractor's Project No.:  
Project: Bonner County Solid Waste Colburn Facility Improvements  
Contract Name: Bonner County Solid Waste Colburn Facility Improvements  
Date Issued: Effective Date of Work Change Directive:

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

Description:

Attachments:

Purpose for the Work Change Directive:

Directive to proceed promptly with the Work described herein, prior to agreeing to change in Contract Price and Contract Time, is issued due to:

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

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

Contract Price: \$ \_\_\_\_\_ [increase] [decrease] [not yet estimated].

Contract Time: \_\_\_\_\_ days [increase] [decrease] [not yet estimated].

Basis of estimated change in Contract Price:

☐ Lump Sum ☐ Unit Price ☐ Cost of the Work ☐ Other

Recommended by Engineer

Authorized by Owner

By:

Title:

Date:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



**CHANGE ORDER NO.: \_\_\_\_**

Owner: Bonner County, Idaho Owner's Project No.: SW023-2023  
Engineer: Great West Engineering Engineer's Project No.: 4-21115  
Contractor: Contractor's Project No.:  
Project: Bonner County Solid Waste Colburn Facility Improvements  
Contract Name: Bonner County Solid Waste Colburn Facility Improvements  
Date Issued: Effective Date of Change Order:

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

Description:

Attachments:

Change in Contract Price	Change in Contract Times
Original Contract Price: \$ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
<b>[Increase] [Decrease]</b> from previously approved Change Orders No. 1 to No. <b>[Number of previous Change Order]</b> : \$ _____	<b>[Increase] [Decrease]</b> from previously approved Change Orders No.1 to No. <b>[Number of previous Change Order]</b> : Substantial Completion: _____ Ready for final payment: _____
Contract Price prior to this Change Order: \$ _____	Contract Times prior to this Change Order: Substantial Completion: _____ Ready for final payment: _____
<b>[Increase] [Decrease]</b> this Change Order: \$ _____	<b>[Increase] [Decrease]</b> this Change Order: Substantial Completion: _____ Ready for final payment: _____
Contract Price incorporating this Change Order: \$ _____	Contract Times with all approved Change Orders: Substantial Completion: _____ Ready for final payment: _____

Recommended by Engineer (if required)

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Authorized by Owner

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Accepted by Contractor

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Approved by Funding Agency (if applicable)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**FIELD ORDER NO.: \_\_\_\_**

Owner:	Bonner County, Idaho	Owner's Project No.:	SW023-2023
Engineer:	Great West Engineering	Engineer's Project No.:	4-21115
Contractor:		Contractor's Project No.:	
Project:	Bonner County Solid Waste Colburn Facility Improvements		
Contract Name:	Bonner County Solid Waste Colburn Facility Improvements		

Date Issued:

Effective Date of Field Order:

Contractor is hereby directed to promptly perform the Work described in this Field Order, issued in accordance with Paragraph 11.04 of the General Conditions, for minor changes in the Work without changes in Contract Price or Contract Times. If Contractor considers that a change in Contract Price or Contract Times is required, submit a Change Proposal before proceeding with this Work.

**Reference:**

Specification Section(s):

Drawing(s) / Details (s):

**Description:**

**Attachments:**

**Issued by Engineer**

By: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

## STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By



Endorsed By



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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

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# STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

## 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 document prepared by Contractor, in a form acceptable to Engineer, to request 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; 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; 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.
- 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.
  - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
  - d. 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), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations 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 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. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
  - 21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *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.
  - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
  - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
  - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *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.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *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.
30. *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.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.
32. *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.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *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.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.
36. *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.
37. *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.
38. *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 or areas furnished by Owner which are designated for the use of Contractor.
39. *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.
40. *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.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers’ instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *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 of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, 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.
46. *Technical Data*
- a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
  - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
  - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *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.
50. *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 Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives:* 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:* The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective:* The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
  - 1. does not conform to the Contract Documents;
  - 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
  - 3. 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 Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
  - 1. The word “furnish,” when used in connection with services, materials, or equipment, means 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, means 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, means 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. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. 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 Performance and Payment Bonds; Evidence of Insurance***

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), 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 signed 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 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 *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 the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will 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.
  - 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents 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 Electronic Documents.

## ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

### 3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document 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 versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will 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.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will 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.
- G. Nothing in the Contract Documents creates:
  - 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
  - 2. 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.

### 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, means 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, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer 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 or Engineer 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 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 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 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 in writing 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.

- 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 notify Owner and Contractor in writing 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 versions, 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 precludes 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 30th 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 60th day after the day of Bid opening or the 30th 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 may 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 must 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 will 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 Contract Price or 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. Such an adjustment will 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 third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and
  - 4. Acts of war or terrorism.

- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
  2. Contractor shall not be entitled to an adjustment in Contract Price 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. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
  3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
1. The circumstances that form the basis for the requested adjustment;
  2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
  3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
  4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
  5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.
- Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.
- F. 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, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses 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.

## **ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS**

### **5.01 *Availability of Lands***

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing 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, or to improvements, structures, utilities, or similar facilities located at such adjacent lands 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 7.13, 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 in a court of competent jurisdiction; 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 will 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 of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
3. Technical Data contained in such reports and drawings.

- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

- C. *Reliance by Contractor on Technical Data:* 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 Paragraph 1.01.A.46.b.

- D. *Limitations of Other Data and Documents:* 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;
  2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
  3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or
  4. 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:
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;
  2. is of such a nature as to require a change in the Drawings or Specifications;
  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 whether it is necessary for Owner to obtain 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; 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. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, 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 subject to the provisions of Paragraphs 4.05.D and 4.05.E.
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;
    - 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 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, then any such adjustment will 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, 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.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

#### 5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
  2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
  4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
  5. 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 on the Drawings, or was not shown or indicated on the Drawings 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), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
  2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
  3. obtain any pertinent cost or schedule information from Contractor; 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
  4. 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. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- F. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, 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. 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;
  - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
  - c. 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, then any such adjustment will 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, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
  4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

#### 5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; 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 on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. 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;
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, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, 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. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- 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, 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.I obligates 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 obligates 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 Contractor's obligations under the Contract. These bonds must 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 terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, 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 must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
- E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
- F. 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.
- G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
- H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

#### 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. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages 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, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages 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, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. 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, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. 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.
- H. Contractor shall require:
  - 1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
  - 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain 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.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) 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 will be adjusted accordingly.



- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, 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 and Engineer.

#### 6.03 *Contractor's Insurance*

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
  - 1. include at least the specific coverages required;
  - 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
  - 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, 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;
  - 4. apply with respect to the performance of the Work, whether such performance is 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; and
  - 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds:* The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
  - 1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
  - 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
  - 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and
5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other 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 Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- 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 advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. 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 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer 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.

1. 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, risks, 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 individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater 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.
  2. None of the above waivers extends 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. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, 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, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
1. 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 all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights 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 insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract 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 fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 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 6.04 shall maintain such proceeds in a segregated account, and 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, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

**ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES**

7.01 *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *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.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *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 maintain good discipline and order at the Site.

- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. 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 will 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.

#### 7.04 *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 must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will 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 must 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.

#### 7.05 *"Or Equals"*

- A. *Contractor's Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, 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 equipment or material, or items from other proposed Suppliers, under the circumstances described below.
  - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
    - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
      - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) 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) has a proven record of performance and availability of responsive service; and
  - 4) is not objectionable to Owner.
- b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
  - 2) the item 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 will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

#### 7.06 Substitutes

- A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material 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 equipment or material under the circumstances described below. To the extent possible such requests must 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 equipment or material from anyone other than Contractor.
  2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.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 equipment or material that Contractor seeks to furnish or use. The application:
  - a. will 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 the item specified; and
    - 3) be suited to the same use as the item 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 the item specified; and
    - 2) available engineering, sales, maintenance, repair, and replacement services.
  - d. will 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 will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers 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 or Supplier 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 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. 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 or Suppliers 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 or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, 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 or Supplier, whether initially or as a replacement, will 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 solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *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 an 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 will be disclosed 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.

#### 7.09 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. 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.

#### 7.10 *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.

#### 7.11 *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. 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 is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written 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 written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

#### 7.12 *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.

### 7.13 *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.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. 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.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.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).
- E. 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.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that 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.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.
- H. 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.

- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will 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.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as 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 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 by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

- 1. Before submitting a Shop Drawing or Sample, Contractor shall:
  - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
  - b. determine and verify:
    - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
    - 2) 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
    - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
  - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.
- 2. Each Shop Drawing or Sample must 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 Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
1. *Shop Drawings*
    - a. Contractor shall submit the number of copies required in the Specifications.
    - b. Data shown on the Shop Drawings must 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.C.
  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.C.
  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. *Engineer's Review of Shop Drawings and Samples*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. 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, comply with the requirements of 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 will 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 or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 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, will 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 or Sample will 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.C.4.

*D. Resubmittal Procedures for Shop Drawings and Samples*

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 Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

*E. Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
  - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
  - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.
  - c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

- d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
- 2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

**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 is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
  - 1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
  - 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
  - 1. abuse, or improper modification, 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.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
  - 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. The end of the correction period established in Paragraph 15.08;
  - 8. Any inspection, test, or approval by others; or

9. Any correction of defective Work by Owner.
- E. 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 will 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 losses, damages, costs, and judgments (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 from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage 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 will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

#### 7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.
- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.



- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
  - 1. Checking for conformance with the requirements of this Paragraph 7.19;
  - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
  - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

## **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 third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. 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.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, 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.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

#### 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 for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, 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. 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 will 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, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will 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 or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

- 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.
  - 1. 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 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 8.03.B.
  - 2. 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 Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify 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 will 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 (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 10.07. 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 *Resident 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 the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

### **10.04 *Engineer's Authority***

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer's authority as to changes in the Work is set forth in Article 11.

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

**10.05 *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.

**10.06 *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.

**10.07 *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, will 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 Contractor under 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 10.07 also apply to the Resident Project Representative, if any.

**10.08 *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 of which Engineer has been informed.

## ARTICLE 11—CHANGES TO THE CONTRACT

### 11.01 *Amending and Supplementing the Contract*

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that 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, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

### 11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
  - 1. Changes in 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 11.05, (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 that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

### 11.03 *Work Change Directives*

- A. 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 11.07 regarding change of Contract Price.

- B. If Owner has issued a Work Change Directive and:
  - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
  - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

#### 11.04 *Field Orders*

- A. 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.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

#### 11.05 *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. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work 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 must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates 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.

#### 11.06 *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.C.2.

#### 11.07 *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 must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must 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);
  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 11.07.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 11.07.C).
- C. *Contractor's Fee:* When applicable, the Contractor's fee for overhead and profit will 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 will be 15 percent;
    - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 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 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.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 5 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 will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
    - d. No fee will 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 of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
    - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

#### 11.08 *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 must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

#### 11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

- B. *Change Proposal Procedures*

- 1. *Submittal:* Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
- 2. *Supporting Data:* 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.
  - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
  - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must 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.

- 3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
- 4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must 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.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *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 in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

#### 11.10 *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 are subject 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;
  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; and
  4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- 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 rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, 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 will 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 will 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 will 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 will 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 will 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 will 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 will be incorporated in a Change Order or other written document 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. When needed 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 will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will 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 in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, 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, will 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 accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will 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, which 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 will 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 or retained for services specifically related to the Work.
  5. Other costs consisting of 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, 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.

- 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
  - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
  - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed 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 builder's risk or other property insurance established in accordance with Paragraph 6.04), 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 include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will 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 does not include any of the following items:
- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
  - 2. The cost of purchasing, renting, or furnishing small tools and hand tools.
  - 3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
  - 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
  - 5. 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.
  - 6. Expenses incurred in preparing and advancing Claims.
  - 7. 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*
- 1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
    - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
    - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
      - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
      - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
  - 2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

- E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

### 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 for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's 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 for Work covered by allowances, and the Contract Price will 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, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
  - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
  - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

**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 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 with such procedures and programs 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 will 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 will 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 will 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 written 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 will 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 additional 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, 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 will 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 defective Work as required by Engineer, then Owner may, after 7 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 for 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.
  - 2. 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 must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) 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.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. 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;
  - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
  - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
  - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; 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 based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from 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 has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
  - j. Liquidated or other 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; or
  - l. Other items entitle 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 will 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 will be treated as an amount due as determined by Paragraph 15.01.D.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 7 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 will 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 7 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 15.03.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 6.04 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 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must 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 duly pending Change Proposals and Claims; 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 Final Application and Recommendation of Payment:* 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 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will 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. 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. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *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 and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

#### 15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

- 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 as a Claim, 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 Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect 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 adjacent areas;
  - 2. correct such defective Work;
  - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, 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 from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, 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 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). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. 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.
- E. 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.

- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to 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 directly attributable to any such suspension. Any Change Proposal seeking such adjustments must 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) 10 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) written 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 7 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 will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

#### 16.03 *Owner May Terminate for Convenience*

- A. Upon 7 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 for any loss of anticipated profits or revenue, post-termination overhead costs, 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 7 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, 7 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, pursuant to Article 12; and
  - 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise 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;
  - 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 requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
  - 1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
  - 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
  - 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

### **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 will not constitute a waiver of that provision, nor will 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 of the Contract or 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 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party 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.

18.09 *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.

18.10 *Headings*

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

## SECTION 00800

### SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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# SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C-700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, "Paragraph SC-4.05."

## ARTICLE 1—DEFINITIONS AND TERMINOLOGY

### SC-1.01 *Defined Terms*

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

*Abnormal Weather Conditions* – Conditions of extreme or unusual weather for a given region, elevation, or season as determined by Engineer. Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered Abnormal Weather Conditions.

**SC-1.01.A.8 – Add the following at the end of the Paragraph:**

**The Change Order form to be used on this Project is EJCDC C-941 (2018). Agency approval is required before Change Orders are effective.**

**SC-1.01.A.30 – Add the following at the end of the Paragraph:**

**For the purposes of Rural Development, this term is synonymous with the term "applicant" as defined in 7 CFR 1780.7 (a) (1), (2) and (3) and is an entity receiving financial assistance from the federal programs.**

**SC-1.01.A.50 – Add the following at the end of the Paragraph:**

**The Work Change Directive form to be used on this Project is EJCDC C-940 (2018). Agency approval is required before a Work Change Directive is issued. A Work Change Directive cannot change Contract Price or Contract times without a subsequent Change Order.**

**SC-1.01.A.51 – Add the following new paragraph immediately after Paragraph 1.01.A.50:**

**51. Agency - The Project is financed in whole or in part by USDA Rural Utilities Service pursuant to the Consolidated Farm and Rural Development Act (7 USC Section 1921 et seq.). The Rural Utilities Service programs are administered through the USDA Rural Development offices; therefore, the Agency for these documents is USDA Rural Development.**

**SC-1.01.A.52 – Add the following new paragraph with the title "American Iron and Steel Definitions" immediately after Paragraph 1.01.A.51:**

**52.a American Iron and Steel (AIS)** - Requirements mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference for “iron and steel products,” meaning the following products, if made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials. AIS requirements apply in each of the several states, the District of Columbia, and each federally recognized Tribe, but not the U.S. Territories.

**52.b Coating** - A covering that is applied to the surface of an object. If a Coating is applied to the external surface of a domestic iron or Steel component, and the application takes place outside of the United States, said product would be considered a compliant product under the AIS requirements. Any Coating processes that are applied to the external surface of Iron and Steel components that would otherwise be AIS compliant would not disqualify the product from meeting the AIS requirements regardless of where the Coating processes occur, provided that final assembly of the product occurs in the United States. This exemption only applies to Coatings on the *external surface* of Iron and Steel components. It does not apply to Coatings or linings on internal surfaces of Iron and Steel products, such as the lining of lined pipes. All Manufacturing Processes for lined pipes, including the application of pipe lining, must occur in the United States for the product to be compliant with AIS requirements.

**52.c Construction Materials** - Those articles, materials, or supplies made primarily of iron and/or steel, that are permanently incorporated into the project, not including mechanical and/or electrical components, equipment and systems. Some of these products may overlap with what is also considered “structural steel”. Note: Mechanical and electrical components, equipment and systems are not considered Construction Materials. See definitions of Mechanical Equipment and Electrical Equipment.

**52.d Contractor’s Certification** - Documentation submitted by the Contractor upon Substantial Completion of the Contract that all Iron and Steel products installed were Produced in the United States.

**52.e De Minimis** - Various miscellaneous, incidental low-cost components that are essential for, but incidental to, the construction and are incorporated into the physical structure of the project. Examples of *De Minimis* components could include small washers, screws, fasteners (such as “off the shelf” nuts and bolts), miscellaneous wire, corner bead, ancillary tube, signage, trash bins, door hardware etc. Costs for such *De Minimis* components cumulatively may comprise no more than a total of five percent of the total cost of the materials used in and incorporated into a project; the cost of an individual item may not exceed one percent of the total cost of the materials used in and incorporated into a project.

**52.f Electrical Equipment** - Typically any machine powered by electricity and includes components that are part of the electrical distribution system. AIS does not apply to Electrical Equipment.

**52.g Engineer’s Certification** - Documentation submitted by the Engineer that Drawings, Specifications, and Bidding Documents comply with AIS.

**52.h Iron and Steel products** - The following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks,

flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials. Only items on the above list made primarily of iron or steel, permanently incorporated into the project must be Produced in the United States. For example, trench boxes, scaffolding or equipment, which are removed from the project site upon completion of the project, are not required to be made of U.S. iron or steel.

**52.i *Manufacturer*** - A Supplier, fabricator, distributor, materialman, or vendor is an entity with which the Owner, Contractor or any subcontractor has contracted to furnish materials or equipment to be incorporated in the project by the Owner, Contractor or a subcontractor.

**52.j *Manufacturer's Certification*** - Documentation provided by the Manufacturer stating that the Iron and Steel products to be used in the project are produced in the United States in accordance with American Iron and Steel (AIS) Requirements. If items are purchased via a Supplier, distributor, vendor, etc. from the Manufacturer directly, then the Supplier, distributor, vendor, etc. will be responsible for obtaining and providing these certifications to the parties purchasing the products.

**52.k *Manufacturing Processes*** - Processes such as melting, refining, pouring, forming, rolling, drawing, finishing, and fabricating. Further, if a domestic Iron and Steel product is taken out of the United States for any part of the manufacturing process, it becomes foreign source material. However, raw materials such as iron ore, limestone and iron and steel scrap are not covered by the AIS requirement, and the material(s), if any, being applied as a Coating are similarly not covered. Non-iron or Steel components of an Iron and Steel product may come from non-US sources. For example, for products such as valves and hydrants, the individual non-Iron and Steel components do not have to be of domestic origin. Raw materials, such as iron ore, limestone, scrap iron, and scrap steel, can come from non-U.S. sources.

**52.l *Mechanical Equipment*** - Typically equipment which has motorized parts and/or is powered by a motor. AIS does not apply to Mechanical Equipment.

**52.m *Minor Components*** - Components *within* an iron and/or Steel product otherwise compliant with the American Iron and Steel requirements; this waiver is typically used by Manufacturers. It differs from the *De Minimis* definition in that *De Minimis* pertains to the entire project and the minor component definition pertains to a single product. This waiver allows use of non-domestically produced miscellaneous Minor Components comprising up to five percent of the total material cost of an otherwise domestically produced Iron and Steel product. However, unless a separate waiver for a product has been approved, all other Iron and Steel components in said product must still meet the AIS requirements. This waiver does not exempt the whole product from the AIS requirements only Minor Components within said product and the iron or Steel components of the product must be produced domestically. Valves and hydrants are also subject to the cost ceiling requirements described here. Examples of Minor Components could include items such as pins and springs in valves/hydrants, bands/straps in couplings, and other low-cost items such as small fasteners etc.

**52.n *Municipal Castings*** - Cast iron or Steel infrastructure products that are melted and cast. They typically provide access, protection, or housing for components incorporated into utility owned drinking water, storm water, wastewater, and solid waste infrastructure.

**52.o *Primarily Iron or Steel*** - A product is made of greater than 50 percent iron or Steel on a materials cost basis. An exception to this definition is reinforced precast concrete (see Definitions). All technical specifications and applicable industry standards (e.g. NIST, NSF,

AWWA) must be met. If a product is determined to be less than 50 percent iron and/or steel, the AIS requirements do not apply. For example, the cost of a fire hydrant includes:

- The cost of materials used for the iron portion of a fire hydrant (e.g. bonnet, body and shoe); and
- The cost to pour and cast to create those components (e.g. labor and energy).

Not included in the cost are:

- The additional material costs for the non-iron or Steel internal workings of the hydrant (e.g. stem, coupling, valve, seals, etc.); and
- The cost to assemble the internal workings into the hydrant body.

**52.p *Produced in the United States*** - The production in the United States of the iron or Steel products used in the project requires that all Manufacturing Processes must take place in the United States, with the exception of metallurgical processes involving refinement of steel additives.

**52.q *Reinforced Precast Concrete*** – Reinforced Precast Concrete structures must comply with AIS, regardless of whether or not it consists of at least 50 percent iron or steel. The reinforcing bar and wire must be Produced in the United States and meet the same standards as for any other iron or Steel product. Additionally, the casting of the concrete product must take place in the United States. The cement and other raw materials used in concrete production are not required to be of domestic origin. If the reinforced concrete is cast at the construction site, the reinforcing bar and wire are considered Construction Materials and must be Produced in the United States.

**52.r *Steel*** - An alloy that includes at least 50 percent iron, between 0.02 and 2 percent carbon, and may include other elements. Metallic elements such as chromium, nickel, molybdenum, manganese, and silicon may be added during the melting of Steel for the purpose of enhancing properties such as corrosion resistance, hardness, or strength. The definition of Steel covers carbon steel, alloy steel, stainless steel, tool steel, and other specialty steels.

**52.s *Structural Steel*** - Rolled flanged shapes, having at least one dimension of their cross-section three inches or greater, which are used in the construction of bridges, buildings, ships, railroad rolling stock, and for numerous other constructional purposes. Such shapes are designated as wide-flange shapes, standard I-beams, channels, angles, tees, and zees. Other shapes include but are not limited to, H-piles, sheet piling, tie plates, cross ties, and those for other special purposes.

## ARTICLE 2—PRELIMINARY MATTERS

### SC-2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01 Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

- A. *Bonds*: Engineer shall furnish to Contractor six copies of the Agreement and other Contract Documents bound therewith. Contractor shall execute the Agreement, attach executed copies of the required Bonds and Power of Attorney, and submit all copies to Engineer who will forward them to the Owner. Owner shall execute all copies and return two copies to the

Contractor. Owner shall also furnish two counterparts or conformed copies to the Engineer and shall retain two copies.

- B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Engineer, Contractor shall also deliver to Engineer copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- C. *Evidence of Owner's Insurance:* After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

#### SC-2.02 *Copies of Documents*

SC-2.02.A Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to the Contractor **one** printed copy of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy electronic portable document format (PDF).

Additional copies of Drawings and Project Manuals may be obtained from the Engineer on the following basis:

Full or partial sets of Drawings	\$5.00 per sheet (Full size)
	\$1.50 per sheet (Half size)
Each book of Specifications	\$150.00

#### SC-2.03 *Before Starting Construction*

SC-2.03.A Add the following new paragraph immediately after Paragraph 2.03.A.3

- 4. A preliminary list of construction equipment with hourly rates, owned or rented by the Contractor and all Subcontractors that will be used in the performance of the Work. The equipment list will include information necessary to confirm the hourly rates per the General Conditions and SC-13.01.B.5.c, including make, model, and year of manufacture as well as the horse power, capacity or weight, and accessories.

#### SC-2.04 *Preconstruction Conference; Designation of Authorized Representatives*

SC-2.04.A Delete Paragraph 2.04.A in its entirety and insert the following in its place:

Before any Work at the Site is started, a conference 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.

The conference shall be attended by authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent. The Contractor shall be responsible for ensuring that all major Subcontractors; Suppliers; and other concerned parties attend the conference. All

participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

***SC-2.05 Initial Acceptance of Schedules***

***SC-2.05.A*** Delete Paragraph 2.05.A in its entirety and insert the following in its place:

- A. Prior to the first application for payment all schedules and documents identified in Paragraph 2.03.A shall be finalized and acceptable to the Engineer and Owner. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer and Owner as provided below. Acceptance of these schedules and documents by either Engineer or Owner will neither impose on Engineer or Owner responsibility for the sequencing, scheduling or progress of the Work and will not interfere with or relieve Contractor from Contractor's full responsibility therefore.

***SC-2.05.A*** Add the following new paragraph immediately after Paragraph 2.05.A.4:

5. Contractor's Schedule of Construction Equipment will be acceptable to Engineer as to form and substance if it provides the necessary information to reference the equipment and establish the hourly rates in accordance with the General Conditions and SC-13.01.B.5.c.

***SC-2.06 Electronic Transmittals***

***SC-2.06*** Add the following new paragraph immediately after Paragraph 2.06.A:

1. Electronic data for Shop Drawings and other submittals may be relied upon if done in accordance with Section 01300.

***SC-2.06*** Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:

- B. Electronic Documents Protocol: The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol ("EDP" or "Protocol") for exchange of electronic transmittals.
  1. Basic Requirements
    - a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Unless otherwise agreed upon, Electronic Documents will only be transmitted and accepted in Portable Document Format (PDF), Microsoft Word Document (DOC), Microsoft Excel Document (XLS), AutoCAD Drawing File (DWG), and Design Web Format (DWF) formats. If another type of file is required, Engineer approval is required. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.
    - b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.

- c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
  - d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.
  - e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party's use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.
  - f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.
2. System Infrastructure for Electronic Document Exchange
- a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions ("System Infrastructure") at its own cost and sufficient for complying with the EDP requirements. With the exception of minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.
    - 1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is twenty (20) MB. Attachments larger than that may be exchanged using large file transfer functions or physical media.
    - 2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.

- b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology ("IT") for maintaining operations of its System Infrastructure during the Project, including coordination with the party's individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
- c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.
- d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.
- e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.
- f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.
- g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.

C. Software Requirements for Electronic Document Exchange; Limitations



1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.
2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.
3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.

### ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

#### 3.01 *Intent*

SC-3.01 Delete Paragraph 3.01.C in its entirety.

### ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

#### SC-4.01 *Commencement of Contract Times; Notice to Proceed*

SC-4.01.A **Amend the first sentence of Paragraph 4.01.A to read as follows:**

**Following execution of the Agreement by the Owner and the Contractor, written Notice to Proceed with the Work shall be given by the Owner to the Contractor. The Contract Time will commence to run on the day indicated in the Notice to Proceed.**

**SC-4.01.A –Delete the last sentence of the paragraph.**

#### SC-4.04 *Progress Schedule*

**SC-4.04.A Delete Paragraph 4.04.A.1 in its entirety and insert the following in its place:**

1. Contractor shall submit to Engineer with each application for payment an updated progress schedule reflecting the amount of work completed and adjustments to future work. Such adjustments will be acceptable to Engineer as providing an orderly progression of the Work to completion within any specified milestones and the Contract Time. No progress payment will be made to Contractor until the updated schedules are submitted to and acceptable to Engineer and Owner. Review and acceptance of progress schedules by the Engineer will neither impose on Engineer responsibility for the sequencing, scheduling or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefore.

#### SC-4.05 *Delays in Contractor's Progress*

SC-4.05.C.2 Amend paragraph 5.04.C.2 by striking out the following words “Abnormal weather conditions;” and inserting the following words “Abnormal Weather Conditions;”

SC-4.05 Amend Paragraph 4.05.C by adding the following subparagraphs:

5. Weather-Related Delays

- a. If “abnormal weather conditions” as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled. **Extreme or unusual weather that is typical for a given region, elevation, or season should not be considered abnormal weather conditions. Requests for time extensions due to abnormal weather conditions will be submitted to the Engineer within five days of the end of the abnormal weather condition event. It is the responsibility of the Contractor to provide the information in Items 1-3 of this paragraph for the Engineer to determine awarded weather days. ~~listed in SC 4.05.C.5.b.~~**

**ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS**

*SC-5.01 Availability of Lands*

SC-5.01 Add the following new paragraph at the end of Paragraph 5.01.C:

If it is necessary or desirable that the Contractor use land outside of the Owner’s easement or right-of-way, the Contractor shall obtain consent from the property owner and tenant of the land. The Contractor shall not enter for materials delivery or occupy for any other purpose with men, tools, equipment, construction materials, or with materials excavated from the site, any private property outside the designated construction easement boundaries or right-of-way without written permission from the property owner and tenant.

*SC-5.03 Subsurface and Physical Conditions*

SC-5.03.A **Amend the first sentence of Paragraph 5.03.A to read as follows:**

**A. Reports and Drawings: The Special Provisions identify:**

SC-5.03.C **Amend the first sentence of Paragraph 5.03.C to read as follows:**

**C. Reliance by Contractor on Technical Data: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Special Provisions with respect to such reports and drawings, but such reports and drawings are not Contract Documents.**

SC-5.03.D Add the following new paragraphs immediately after Paragraph 5.03.D:

- E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
<u>Geotechnical Report Bonner County Solid Waste Colburn Site Improvements Project (by GPI)</u>	<u>February 2023</u>	<u>Geotechnical Evaluation and Recommendations (Appendix 1 to the Project Manual)</u>

- F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
<u>NO SUCH DRAWINGS</u>		

- G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at Bonner County Engineering Department, 1500 Highway 2, Suite 101, Sandpoint, ID 83864 during regular business hours, or may request copies from Engineer.

**SC-5.04 Differing Subsurface of Physical Conditions**

**SC.5.04.A Add the following new paragraph at the end of Paragraph 5.04.A:**

Contractor to notify Owner and Engineer in writing about differing subsurface or physical conditions within 15 days of discovery and before disturbing the subsurface as stated above.

No claim for an adjustment in the contract price or contract times (or Milestones) will be valid for differing subsurface or physical conditions if procedures of this Paragraph 5.04 are not followed.

**SC-5.05 Underground Facilities**

**SC-5.05.A Add the following new paragraph immediately after Paragraph 5.05.A.5:**

- 6. At least 2 but not more than 10 business days before beginning any excavation, the Contractor shall, in accordance with Idaho Code 55-2205, notify all owners of underground facilities and coordinate the Work with the owners of such underground facilities. The information shown or indicated in the Contract Documents with respect to existing underground facilities is based on information and data obtained from the owners of the facilities without field exploration, and as such, Owner and Engineer are not responsible for the accuracy or completeness of such information or data.**

**SC-5.06 Hazardous Environmental Conditions**

**SC-5.06.A Amend the first sentence of Paragraph 5.06.A to read as follows:**

**A. Reports and Drawings: The Special Provisions identify:**

**SC-5.06.B Amend the first sentence of Paragraph 5.06.B to read as follows:**

**B. Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Special Provisions with respect to such reports and drawings, but such reports and drawings are not Contract Documents.**

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
<u>NO SUCH REPORTS</u>		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
<u>NO SUCH DRAWINGS</u>		

**ARTICLE 6—BONDS AND INSURANCE**

**SC6.01 Performance, Payment, and Other Bonds**

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.A:

1. Required Performance Bond Form: The performance bond that Contractor furnishes will be in the form of EJCDC® C-610, Performance Bond **(2018 edition)**.
2. Required Payment Bond Form: The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond **(2018 edition)**.

**SC-6.02 Insurance—General Provisions**

SC-6.02.B Delete Paragraph 6.02.B in its entirety and insert the following in its place:

- B. Without limiting any of the other obligations or liabilities of the Contractor, Contractor shall secure and maintain such insurance from an insurance company (or companies) authorized to write insurance in the State of Idaho, with minimum “A.M. Best Rating” of A-VI, as will protect the Contractor, the vicarious acts of subcontractors, the Owner and the Engineer and their agents and employees from claims for bodily injury, or property damage which may arise from operations and completed operations under this Agreement. Contractor shall not commence work under this Agreement until such insurance has been obtained and certificates of

insurance, with binders, or certified copies of the insurance policy shall have been filed with the Owner and the Engineer.

All insurance coverages shall remain in effect throughout the life of the Agreement, except that the Contractor shall maintain the Commercial General Liability Policy including product and completed operations coverage for a period of at least three years following the substantial completion date for property damage resulting from occurrences during the agreement period.

SC-6.02.B 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 within the last 12 months.

**SC-6.03 Contractor's Insurance**

SC-6.03 Amend Paragraph 6.03.B.4 by striking out the word "and" at the end of the Paragraph.

SC-6.03 Amend Paragraph 6.03.B.5 to read as follows:

5. include all necessary endorsements to support the stated requirements; and

SC-6.03 Add the following paragraph immediately after Paragraph 6.03.B.5:

6. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 45 days prior to 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 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: Engineer's Consultants, the State, its officers, officials, employees, and volunteers.
- E. *Workers' Compensation and Employer's Liability:* Contractor shall purchase and maintain workers' compensation and employer's liability insurance, including, as applicable, United States Longshoreman and Harbor Workers' Compensation Act, Jones Act, stop-gap employer's liability coverage for monopolistic states, and foreign voluntary workers' compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

<b>Workers' Compensation and Related Policies</b>	<b>Policy limits of not less than:</b>
<b>Workers' Compensation</b>	
State	Statutory

<b>Workers' Compensation and Related Policies</b>	<b>Policy limits of not less than:</b>
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
<b>Jones Act (if applicable)</b>	
Bodily injury by accident—each accident	<u>\$1,000,000</u>
Bodily injury by disease—aggregate	<u>\$1,000,000</u>
<b>Employer's Liability</b>	
Each accident	<u>\$1,000,000</u>
Each employee	<u>\$1,000,000</u>
Policy limit	<u>\$1,000,000</u>
<b>Stop-gap Liability Coverage</b>	
For work performed in monopolistic states, stop-gap liability coverage must be endorsed to either the worker's compensation or commercial general liability policy with a minimum limit of:	<u>\$1,000,000</u>

- F. *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 claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
  2. damages insured by reasonably available personal injury liability coverage, and
  3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability*—Form and Content: Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
    - a. Such insurance must 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, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
  3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
  4. Underground, explosion, and collapse coverage.
  5. Personal injury coverage.

6. 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). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
  7. 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.
- H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
  2. Any exclusion for water intrusion or water damage.
  3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
  4. Any exclusion of coverage relating to earth subsidence or movement.
  5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
  6. Any limitation or exclusion based on the nature of Contractor's work.
  7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

<b>Commercial General Liability</b>	<b>Policy limits of not less than:</b>
General Aggregate	<u>\$3,000,000</u>
Products—Completed Operations Aggregate	<u>\$3,000,000</u>
Personal and Advertising Injury	<u>\$2,000,000</u>
Bodily Injury and Property Damage—Each Occurrence	<u>\$2,000,000</u>

- J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance 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 must be written on an occurrence basis.

<b>Automobile Liability</b>	<b>Policy limits of not less than:</b>
<b>Bodily Injury</b>	
Each Person	<u>\$2,000,000</u>

<b>Automobile Liability</b>	<b>Policy limits of not less than:</b>
Each Accident	<u>\$2,000,000</u>
<b>Property Damage</b>	
Each Accident	<u>\$2,000,000</u>
<b>[or]</b>	
<b>Combined Single Limit</b>	
Combined Single Limit (Bodily Injury and Property Damage)	<u>\$2,000,000</u>

- K. *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. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

<b>Excess or Umbrella Liability</b>	<b>Policy limits of not less than:</b>
Each Occurrence	<u>\$1,000,000</u>
General Aggregate	<u>\$2,000,000</u>

- L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements*: Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of \$500,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

- M. *Contractor's Pollution Liability Insurance*: Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

<b>Contractor's Pollution Liability</b>	<b>Policy limits of not less than:</b>
Each Occurrence/Claim	<u>\$3,000,000</u>
General Aggregate	<u>\$5,000,000</u>

- N. *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 must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable.



The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

<b>Contractor's Professional Liability</b>	<b>Policy limits of not less than:</b>
Each Claim	<u>\$2,000,000</u>
Annual Aggregate	<u>\$3,000,000</u>

O. ~~*Railroad Protective Liability Insurance:* Prior to commencing any Work within 50 feet of railroad owned and controlled property, Contractor shall (1) endorse its commercial general liability policy with ISO CG 24 17, removing the contractual liability exclusion for work within 50 feet of a railroad, (2) purchase and maintain railroad protective liability insurance meeting the following requirements, (3) furnish a copy of the endorsement to Owner, and (4) submit a copy of the railroad protective policy and other railroad required documentation to the railroad, and notify Owner of such submittal.~~

P. *Unmanned Aerial Vehicle Liability Insurance:* If Contractor uses unmanned aerial vehicles (UAV—commonly referred to as drones) at the Site or in support of any aspect of the Work, Contractor shall obtain UAV liability insurance in the amounts stated; name Owner, Engineer, and all individuals and entities identified in the Supplementary Conditions as additional insureds; and provide a certificate to Owner confirming Contractor's compliance with this requirement. Such insurance will provide coverage for property damage, bodily injury or death, and invasion of privacy.

<b>Unmanned Aerial Vehicle Liability Insurance</b>	<b>Policy limits of not less than:</b>
Each Claim	<u>\$100,000</u>
General Aggregate	<u>\$100,000</u>

Q. *Other Required Insurance:* NONE

SC-6.04 *Builder's Risk and Other Property Insurance*

**SC-6.04 A Delete the first optional paragraph SC-6.04 A. that begins with, "Owner shall purchase and maintain builder's risk insurance..."**

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition

occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

- a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.
  - b. 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 will be provided through other insurance policies acceptable to Owner and Contractor.
2. 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.
  3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).
  4. 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). If this coverage is subject to a sublimit, such sublimit will be a minimum of \$250,000.
  5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of \$500,000.
  6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.
  7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.
  8. include performance/hot testing and start-up, if applicable.
  9. be maintained in effect until the Work is complete, as set forth in Paragraph 15.06.D of the General Conditions, or until written confirmation of Owner's procurement of property insurance following Substantial Completion, whichever occurs first.
  10. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be

insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds." In addition to Owner, Contractor, and Subcontractors of every tier, include as insureds the following:

a. NONE

11. ~~include, in addition to the Contract Price amount, the value of the following equipment and materials to be installed by the Contractor but furnished by the Owner or third parties:~~

a. NONE

12. ~~If debris removal in connection with repair or replacement of insured property is subject to a coverage sublimit, such sublimit will be a minimum of \$[amount].~~

13. ~~In addition to the coverage sublimits stated above, the following coverages are also subject to sublimits, as follows:~~

a. ~~[Here list a specific coverage, or cause of loss, that has been determined to be likely to be subject to a sublimit. If not applicable, then delete Paragraph SC 6.04.F.13 in its entirety.] If this coverage is subject to a sublimit, such sublimit will be a minimum of \$[amount].~~

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provision:

G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, compensation for loss of net revenues, rental costs, and attorneys' fees and engineering or other consultants' fees, if not otherwise covered.

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

1. ~~The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than \$[number] for direct physical loss in any one occurrence.~~

SC-6.04 Delete Paragraph 6.04.A of the General Conditions and substitute the following in its place:

A. *Installation Floater*

1. Contractor shall provide and maintain installation floater insurance on a broad form or "all risk" policy providing coverage for materials, supplies, machinery, fixtures, and equipment that will be incorporated into the Work ("Covered Property"). Coverage

under the Contractor's installation floater will include loss from covered "all risk" causes (perils) to Covered Property:

- a. of the Contractor, and Covered Property of others that is in Contractor's care, custody, and control;
  - b. while in transit to the Site, including while at temporary storage sites;
  - c. while at the Site awaiting and during installation, erection, and testing;
  - d. continuing at least until the installation or erection of the Covered Property is completed, and the Work into which it is incorporated is accepted by Owner.
2. The installation floater coverage cannot be contingent on an external cause or risk, or limited to property for which the Contractor is legally liable.
  3. The installation floater coverage will be in an amount sufficient to protect Contractor's interest in the Covered Property. The Contractor will be solely responsible for any deductible carried under this coverage.
  4. This policy will include a waiver of subrogation applicable to Owner, Contractor, Engineer, all Subcontractors, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them.

**SC-6.05 Property Losses; Subrogation**

**SC-6.05.A.1 Revise paragraph 6.05.A.1 to read as follows:**

**Contractor waives all rights against the Owner and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waives all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the other officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.**

**SC-6.05.B Delete paragraph 6.05.B in its entirety.**

**ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES**

SC-7.03 Amend the first and second sentences of Paragraph 7.03.C to state "...all Work at the Site must be performed during regular working hours, **Monday** through **Friday**. Contractor will not perform Work on a **Saturday, Sunday**, or any legal holiday."

SC-7.03 Delete Paragraph 7.03.C in its entirety, and insert the following:

~~C. In the absence of any Laws or Regulations to the contrary, 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-7.03 Add the following new paragraph immediately after Paragraph 7.03.C:

- D. **Contractor ~~[Owner]~~** 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. If Contractor is responsible but does not pay, or if 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-7.03 Add the following new subparagraph immediately after Paragraph SC-7.03.D:

1. For purposes of administering the foregoing requirement, additional overtime costs are defined per Specification 00500 Agreement between Owner and Contractor for Construction Contract, section 4.06 Special Damages.

SC-7.04 *Services, Materials, and Equipment*

SC-7.04.D – Add the following new paragraph immediately after Paragraph 7.04.C:

- D. All Iron and Steel products must meet American Iron and Steel requirements.

SC-7.04.E – Add the following new paragraph immediately after Paragraph 7.04.D:

- E. For projects utilizing a De Minimis waiver, Contractor shall maintain an itemized list of non-domestically produced iron or steel incidental components and ensure that the cost is less than 5% of total materials cost for project.

SC-7.05 *"Or Equals"*

SC-7.05.A – Amend the third sentence of paragraph by striking out the following words:

Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item is permitted,

SC-7.05.A.1.a.3 – Amend the last sentence of Paragraph a.3 by striking out "and;" and adding a period at the end of Paragraph a.3.

SC-7.05.A.1.a.4 – Delete paragraph in its entirety and insert "Deleted."

SC-7.05.B – Add the following at the end of paragraph:

Contractor shall include a Manufacturer's Certification letter for compliance with American Iron and Steel requirements in support data, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-7.06 *Substitutes*

SC-7.06.A.3.a.2 – Remove "and" from the end of paragraph.

SC-7.06.A.3.a.3 – Add "; and" to the end of paragraph.

SC-7.06.A.3.a.4 – Add the following new paragraph immediately after Paragraph 7.06.A.3.a.3:

4. Comply with American Iron and Steel by providing Manufacturer's Certification letter of American Iron and Steel compliance, if applicable. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-7.07 *Concerning Subcontractors and Suppliers*

SC-7.07.A – Amend by adding the following to the end of the paragraph:

**The total amount of work subcontracted by the Contractor shall not exceed fifty percent of the Contract price without prior approval from the Owner, Engineer and Agency.**

SC-7.07.B – Delete paragraph in its entirety and insert "Deleted".

SC-7.07.D - Amend the first sentence of Paragraph 7.07.D to read as follows:

**Within seven (7) days of Owner's request, Contractor shall identify Subcontractors, Suppliers, or other individuals or entities as may be called for in the Special Provisions.**

SC-7.07.E – Delete the second sentence of paragraph and insert the following in its place:

**Owner may not require that Contractor use a specific replacement.**

SC 7.10 *Taxes*

SC-7.10 Delete section 7.10 in its entirety.

SC-7.12 *Record Documents*

SC-7.12.A-Amend paragraph by adding the following after "written interpretations and clarifications,":

Manufacturers' Certifications

SC-7.13 *Safety and Protection*

SC-7.13.G Amend the second sentence of Paragraph 7.13.G by striking out the words "Supplementary Conditions" and replacing them with the words "Special Provisions".

SC-7.13 Insert the following after the second sentence of Paragraph 7.13.G:

The following Owner safety programs are applicable to the Work: **NONE**

SC-7.13.J Add the following new paragraphs immediately after Paragraph 7.13.J:

**K. It is expressly understood by the parties to this Agreement that the Contractor is solely responsible for initiating, maintaining, and supervising safety precautions and programs in connection with the Work. The right of the Owner and Engineer to observe or otherwise review the Work and operations shall not relieve the Contractor from any of his covenants and obligations hereunder. Contractor shall incorporate all safety requirements into his construction progress and work schedules including preconstruction and scheduled monthly safety meetings, posted safety rules, tailgate meetings, and site inspections by safety and other inspectors employed by the Contractor.**

**L. The Contractor shall be responsible for and shall take necessary precautions and provide all material and equipment to protect, shore, brace, support and maintain all underground pipes, conduits, drains, sewers, water mains, gas mains, cables, etc., and other underground construction uncovered in the proximity, or otherwise affected by the construction work performed by him. All pavement, surfacing, driveways, curbs, walks, buildings, grass areas, trees, utility poles or guy**

wires damaged by the Contractor's operations in the performance of this work shall be repaired and/or replaced to the satisfaction of the Owner, Engineer, and effected property owner at the Contractor's expense. The Contractor shall also be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, or other public or private property or facility, regardless of location or character, which may be caused by moving, hauling, or otherwise transporting equipment, materials, or men to and from the work or any part of site thereof; whether by him or his subcontractors. The Contractor shall make satisfactory and acceptable arrangements with owner of, or the agency or authority having jurisdiction over, the damaged property or facility concerning its repair or replacement or payment of costs incurred in connection with said damage.

M. The Contractor shall conduct his work so as to interfere as little as possible with public travel, whether vehicular or pedestrian. Whenever it is necessary to cross, obstruct, or close roads, driveways, and walks, whether public or private, the Contractor shall obtain approval from the governing party and shall, at his own expense, provide and maintain suitable and safe bridges, detours, and other temporary expedients for the accommodation of public and private drives before interfering with them. The provisions for temporary expedients will not be required when the Contractor has obtained permission from the owner and tenant of the private property, or from the authority having jurisdiction over public property involved, to obstruct traffic at the designated point.

N. Safety provisions must be entirely adequate and meet with City or State and Federal regulations to protect the public on these streets and roads.

*SC-7.16 Submittals*

SC-7.16.A.1.c – Amend paragraph by deleting the last period and adding:

, including Manufacturer's Certification letter for any item in the submittal subject to American Iron and Steel requirements and include the Certificate in the submittal. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-7.16.C.9 – Add new paragraph immediately after Paragraph 7.16.C.8:

9. Engineer's review and approval of a Shop Drawing or Sample shall include review of Manufacturers' Certifications in order to document compliance with American Iron and Steel requirements, as applicable.

SC-7.17.F – Add new paragraph immediately after Paragraph 7.17.E:

F. Contractor shall certify upon Substantial Completion that all Work and Materials have complied with American Iron and Steel requirements as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Contractor shall provide said Certification to Owner. Refer to General Contractor's Certification Letter provided in these Contract Documents.

*SC-7.18 Indemnification*

SC-7.18.A Add the following new paragraph at the end of Paragraph 7.18.A:

While Owner and Engineer may have the right under this Contract to observe or otherwise review the work, progress and operations of the Contractor, it is expressly understood and agreed that such observation shall not relieve the Contractor from any of its covenants and obligations hereunder.

## ARTICLE 8—OTHER WORK AT THE SITE

SC-8.02 *Coordination*

SC-8.02 Delete Paragraph 8.02 in its entirety and replace with the following:

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 Special Provisions 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 Special Provisions, Owner shall have sole authority and responsibility for such coordination.

## ARTICLE 9—NO CHANGES

## ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

SC-10.03 *Resident Project Representative*

~~SC-10.03—Add the following new subparagraph immediately after Paragraph 10.03.A:~~

- ~~1. On this Project, by agreement with the Owner, the Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.~~

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:



1. **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.**
2. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
3. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
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 Contractor's proper execution of the Work.
5. **Interpretation of Contract Documents: Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.**
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. **Modifications: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report such suggestions, together with RPR's recommendations, if any, to Engineer. Transmit to Contractor in writing decisions as issued by Engineer.**
8. *Review of Work; Defective Work:*

- a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
- b. Observe whether any Work in place appears to be defective.
- c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
- d. 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.**

9. *Inspections, Tests, and System Start-ups:*

- a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
- b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
- c. Verify that tests, equipment, and systems start-ups and operating and maintenance training are conducted in the presence of appropriate Owner's personnel, and that Contractor maintains adequate records thereof.**
- d. Observe, record, and report to Engineer appropriate details relative to the test procedures and systems start-ups.**

**10. Reports:**

- a. Furnish to Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the Progress Schedule and schedule of Shop Drawing and Sample submittals.**
- b. ~~Draft and recommend to Engineer proposed Change Orders, Work Change Directives, and Field Orders. Obtain backup material from Contractor.~~**
- c. Immediately notify Engineer of the occurrence of any Site accidents, emergencies, acts of God endangering the Work, force majeure or delay events, damage to property by fire or other causes, or the discovery of any Constituent of Concern or Hazardous Environmental Condition.**

11. *Payment Requests:* Review Applications for Payment with Contractor.

**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 regarding Substantial Completion.
- b. Assist in the preparation of a punch list of items to be completed or corrected.
- c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
- d. Observe whether items on the final punch list have been completed or corrected.

**D. The RPR will 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.
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. Authorize Owner to occupy the Project in whole or in part.

**ARTICLE 11—CHANGES TO THE CONTRACT**

**SC-11.02 Change Orders**

**SC-11.02.C – Add new paragraph immediately after Paragraph 11.02.B:**

- C. The Engineer or Owner shall contact the Agency for concurrence on each Change Order prior to issuance. All Contract Change Orders must be concurred on (signed) by Agency before they are effective.**

SC-11.03 *Work Change Directives*

SC-11.03.A.2 - **Add new Paragraph 11.03.A.2 immediately after Paragraph 11.03.A, which shall be renamed Paragraph 11.03.A.1:**

2. The Engineer or Owner shall contact the Agency for concurrence on each Work Change Directive prior to issuance. Once authorized by Owner, a copy of each Work Change Directive shall be provided by Engineer to the Agency.

SC-11.05 *Owner-Authorized Changes in the Work*

SC-11.05.B – **Add the following at the end of this paragraph:**

For Owner-authorized changes in the Work, the Contractor will provide the Manufacturer's Certification(s) for materials subject to American Iron and Steel requirements except when sole-source is specified, in which case the Engineer will provide the Manufacturer's Certification(s).

SC-11.09 *Change Proposals*

SC-11.09.B.2.c – **Add new paragraph immediately after Paragraph 11.09.B.2.b:**

- c. Change orders involving materials subject to American Iron and Steel requirements shall include supporting data (name of Manufacturer, city and state where the product was manufactured, description of product, signature of authorized Manufacturer's representative) in the Manufacturer's Certification Letter, as applicable.

**ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK**

SC-13.01 *Cost of the Work*

SC-13.01.B.5.c **Delete paragraph 13.01.B.5.c in its entirety and insert the following in its place:**

- c. The rental of all construction equipment and machinery and parts thereof whether rented from contractor or rented from others. The cost shall be calculated as follows and will include the costs of transportation, loading, unloading, assembly, dismantling and removal thereof for equipment involved only in the changed portion of the work covered under the cost of the Work method. Transportation, loading and assembly costs will not be included for equipment already on the site which is being used for other portions of the Work. The cost of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work. Hourly equipment and machinery rates shall be calculated from the Rental Rate Blue Book for Construction Equipment, and the Equipment List submitted according to SC-2.03 and SC-2.05, and as follows:
  1. for working equipment, the hourly rate shall be the monthly rental rate divided by 176 hours per month plus the hourly operating cost.
  2. for equipment on standby, the hourly rate shall be 50% of the monthly rental rate divided by 176 hours per month, and the hourly operating cost shall not be applied.

**3. for specialized equipment rented for a short duration used for change order work or additional work not part of the scope of work bid, the equipment rental rates will be negotiated prior to the work being performed.**

SC-13.01.C.2 Add the following definition of small tools and hand tools:

- a. For purposes of this paragraph, “small tools and hand tools” means any tool or equipment whose current price if it were purchased new at retail would be less than \$500.

*SC-13.02 Allowances*

SC-13.02.C – **Delete paragraph in its entirety and insert “Deleted”.**

*SC-13.03 Unit Price Work*

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

**E. Adjustments in Unit Price**

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
  - a. the extended price of a particular item of Unit Price Work amounts to ten percent (10%) 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 twenty-five (25%) percent from the estimated quantity of such item indicated in the Agreement; and
  - b. Contractor’s unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor’s costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

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

*SC-14.03 Defective Work*

SC-14.03.G – **Add new paragraph immediately after Paragraph 14.03.F:**

- G. Installation of materials that are non-compliant with American Iron and Steel requirements shall be considered defective work.

**ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD**

*SC-15.01 Progress Payments*

SC-15.01.B.2 - Add the following new paragraph at the end of Paragraph 15.01.B.2:

Reflect Change Orders approved as of the date of the Application in each Application for Payment.

For stored materials and equipment, provide clear descriptions of the materials and equipment, the relation of materials and equipment to individual bid items, and the dollar values of materials and equipment stored and in place. The amount allowed for materials and equipment in storage shall not exceed the value of material remaining to be installed less the value of installation. Progress payments for stored materials and equipment to Contractor will not include any overhead or profit.

SC-15.01.B.4 – Add the following language at the end of paragraph:

No payments will be made that would deplete the retainage, place in escrow any funds that are required for retainage or invest the retainage for the benefit of the Contractor.

SC-15.01.B.4 - Add the following new paragraphs at the end of Paragraph 15.01.B.4:

Retainage may be used by the Owner to offset costs for any of the losses enumerated in Paragraphs 15.01.C.6.a through 15.01.C.6.e inclusive, 15.01.E.1.a through 15.01.E.1.i inclusive, or 16.02.E. In addition, retainage may be used by the Owner to protect against loss from failure by the Contractor to complete necessary work and to offset any liquidated damages due Owner.

Each application for progress payment shall be accompanied by Contractor's updated progress schedule, shop drawing schedule, procurement schedule, subcontractor or supplier lien releases from previous pay application, and other data specified herein or reasonably required by Owner or Engineer. The Owner reserves the right to require submission of weekly certified payrolls by the Contractor.

The Application for Payment form to be used on this Project is EJCDC® C-620. The Agency must approve all Applications for Payment before payment is made.

By submitting an Application for Payment based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials are compliant with American Iron and Steel requirements. Manufacturer's Certification letter for materials satisfy this requirement. Refer to Manufacturer's Certification Letter provided in these Contract Documents.

SC-15.01.B.5 – Add new paragraph immediately after Paragraph 15.01.B.4:

5. The Application for Payment form to be used on this Project is EJCDC® C-620. The Agency must approve all Applications for Payment before payment is made.

SC-15.01.C.2.d – Add the following new paragraph immediately after Paragraph 15.01.C.2.c:

- d. The materials presented for payment in an Application for Payment comply with American Iron and Steel requirements.

SC-15.01.D.1 – Delete paragraph in its entirety and insert the following in its place:

The Application for Payment with Engineer's recommendations will be presented to the Owner and Agency for consideration. If both the Owner and Agency find the Application for Payment acceptable, the recommended amount less any reduction under the provisions of Paragraph 15.01.E will become due twenty (20) days after the Application for Payment is presented to the Owner, and the Owner will make payment to the Contractor.

SC-15.01.E.1.I - Add the following language at the end of the first sentence of Paragraph 15.01.E.1.I:  
, including liquidated damages.

SC-15.01.F Add the following new Paragraph 15.01.F:

- F. For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.

implement the plan as modified for all remaining Applications for Payment.

SC-15.02 *Contractor's Warranty of Title*

SC-15.02.A – Amend paragraph by striking out the following text: "7 days after".

SC-15.02.B Add the following new paragraph immediately after Paragraph 15.02.A:

- B. Neither recommendation of any progress payment by Engineer nor payment by the Owner to Contractor, nor any use or occupancy of the Work or any part thereof will release the Contractor from complying with the Contract Documents. Specifically, the Contractor shall maintain in accordance with Article 6, property insurance on all Work, materials, and equipment whether incorporated in the project or not and whether included in an application for payment or not, for the full insurable value thereof. Passing title to Owner for materials and equipment included in an application for payment does not relieve the Contractor of the Contractor's obligation to provide insurance (including property insurance) as required in Article 6 of the General Conditions and these Supplementary Conditions. All insurance shall remain in effect as provided in Article 6.

SC-15.03 *Substantial Completion*

SC-15.03.A – Modify by adding the following after the last sentence:

Contractor shall also submit the General (Prime) Contractor's Certification of Compliance certifying that to the best of the Contractor's knowledge and belief all substitutes, equals, and all Iron and Steel products proposed in the Shop Drawings, Change Orders, and Partial Payment Estimates, and those installed for the Project, are either Produced in the United States or are the subject of an approved waiver under Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference.

SC-15.03 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, will 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 this Article 15.

SC-15.04 *Partial Use or Occupancy*

SC-15.04 **Add the following new paragraph immediately after Paragraph 15.04.A.4:**

**B. Owner has the right to take possession of or use any completed or substantially completed portions of the work at any time, but such taking possession or use will not be deemed an acceptance of any work not completed in accordance with the Contract Documents. Owner's use of any facilities so identified in the Contract Documents will not be grounds for extension of the contract time or change in the contract price. Owner's use of any facilities not specifically identified in the Contract Documents will be in accordance with conditions agreed to prior to such use, and any extra costs or delays in completion incurred and properly claimed by Contractor will be equitably adjusted with a Change Order. Facilities substantially completed in accordance with the Contract Documents which are occupied or used by Owner prior to substantial completion of the entire work will be done in accordance with General Conditions 15.03. Guarantee periods for accepted or substantially completed work including mechanical and electrical equipment will commence upon the start of continuous use by Owner. All tests and instruction of Owner's personnel must be satisfactorily completed, and Owner shall assume responsibility for and operation of all facilities occupied or used except as may arise through portions of work not yet completed by Contractor. If the work has been substantially completed and the Engineer certifies that full completion thereof is materially delayed through no fault of the Contractor, the Owner shall, without terminating the Agreement, make payment of the balance due for the portion of the work fully completed and accepted.**

SC-15.05 *Final Inspection*

SC-15.05 **Add the following new paragraph immediately after Paragraph 15.05.A:**

**B. After Contractor has remedied all deficiencies to the satisfaction of the Engineer and delivered all construction records, maintenance and operating instructions,**



schedules, guarantees, bonds, certificates of inspection, and other documents (all as required by the Contract Documents), Owner and Contractor shall be promptly notified in writing by Engineer that the work is acceptable.

SC-15.08 — Add the following new Paragraph 15.08.G:

- G. ~~The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC 6.01.B.1; or if no such revision has been made in SC 6.01.B, then the correction period is hereby specified to be [number] years after Substantial Completion.~~

## ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

SC-16.01 *Owner May Suspend Work*

SC-16.01 Add the following new paragraph immediately after Paragraph 16.01.A

- B. Owner may also suspend the Work or any portion thereof at the request of the Contractor by written notice to Contractor and Engineer. Contractor shall make such a request in writing to the Owner and furnish a copy of the request to the Engineer. If the Owner grants the Contractor's request to suspend the Work, Contractor will not be entitled to an adjustment in the Contract Price or an extension of the Contract Times, directly attributable to the suspension. However, the days which expire during the suspension would not be counted against Contract Times.

## ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

SC-17.02 *Attorneys' Fees*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

SC-17.02 Attorneys' Fees

- A. 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.

## ARTICLE 18—MISCELLANEOUS

SC-18.01 *Giving Notice*

SC-18.01 Add the following new paragraph immediately after Paragraph 18.01.A:

- B. The mailing address for giving notices to Contractor given in the Agreement is hereby designated as the place to which all notices, letters, and other communication to Contractor will be mailed or delivered. The mailing address for giving notices to Owner given in the Agreement is hereby designated as the place

**to which all notices, letters, and other communication to Owner shall be mailed or delivered. Either party may change his address at any time by an instrument in writing delivered to Engineer and to other party.**

**SC-18.08**      *Assignment of Contract - DELETED*

SC-18.08      Add the following new paragraph immediately after Paragraph 18.08.A:

- ~~B. The contract dated [date] between Owner as “buyer” and Lemna Technologies as “seller” for procurement of goods and special services (“procurement contract”) will be assigned to Contractor by Owner, and Contractor will accept such assignment. A form documenting the assignment is attached as an exhibit to this Contract.~~
- ~~1. This assignment will occur on the Effective Date of the Contract, and will relieve the Owner as “buyer” from all further obligations and liabilities under the procurement contract.~~
  - ~~2. Upon assignment, the “seller” will be a Subcontractor or Supplier of the Contractor, and Contractor will be responsible for seller’s performance, acts, and omissions, as set forth in Paragraph 7.07 of the General Conditions just as Contractor is responsible for all other Subcontractors and Suppliers.~~
  - ~~3. Notwithstanding this assignment, all performance guarantees and warranties required by the procurement contract will continue to run for the benefit of the Owner and, in addition, for the benefit of the Contractor.~~
  - ~~4. Except as noted in the procurement contract, all rights, duties and obligations of Engineer to “buyer” and “seller” under the procurement contract will cease upon the assignment to Contractor.~~

**SC-18.11**      *Tribal Sovereignty*

SC-18.11 – Add new paragraph immediately after Paragraph 18.10:

- A. No provision of this Agreement will be construed by any of the signatories as abridging or debilitating any sovereign powers of any Federally recognized Tribe; affecting the trust-beneficiary relationship between the Secretary of the Interior, Tribe, and Indian landowner(s); or interfering with the government-to-government relationship between the United States and the Tribe.**

**Add the following new Article 19 immediately after Article 18:**

**ARTICLE 19—FEDERAL REQUIREMENTS**

**SC-19.01**      *Agency Not a Party*

- A. This Contract is expected to be funded in part with funds provided by Agency. Neither Agency, nor any of its departments, entities, or employees, is a party to this Contract.**

**SC-19.02**      *Contract Approval*

- A. Owner and Contractor will furnish Owner’s attorney such evidence as required so that Owner’s attorney can complete and execute the “Certificate of Owner’s**

Attorney" (Exhibit G of this Bulletin) before Owner submits the executed Contract Documents to Agency for approval.

- B. Agency concurrence is required on both the Bid and the Contract before the Contract is effective.

**SC-19.03**      ***Conflict of Interest***

- A. Contractor may not knowingly contract with a Supplier or Manufacturer if the individual or entity who prepared the Drawings and Specifications has a corporate or financial affiliation with the Supplier or Manufacturer. Owner's officers, employees, or agents shall not engage in the award or administration of this Contract if a conflict of interest, real or apparent, would be involved. Such a conflict would arise when: (i) the employee, officer or agent; (ii) any member of their immediate family; (iii) their partner or (iv) an organization that employs, or is about to employ, any of the above, has a financial interest or other interest in or a tangible personal benefit from the Contractor. Owner's officers, employees, or agents shall neither solicit nor accept gratuities, favors or anything of monetary value from Contractor or subcontractors.

**SC-19.04**      ***Gratuities***

- A. If Owner finds after a notice and hearing that Contractor, or any of Contractor's agents or representatives, offered or gave gratuities (in the form of entertainment, gifts, or otherwise) to any official, employee, or agent of Owner or Agency in an attempt to secure this Contract or favorable treatment in awarding, amending, or making any determinations related to the performance of this Contract, Owner may, by written notice to Contractor, terminate this Contract. Owner may also pursue other rights and remedies that the law or this Contract provides. However, the existence of the facts on which Owner bases such findings shall be an issue and may be reviewed in proceedings under the dispute resolution provisions of this Contract.
- B. In the event this Contract is terminated as provided in paragraph 19.04.A, Owner may pursue the same remedies against Contractor as it could pursue in the event of a breach of this Contract by Contractor. As a penalty, in addition to any other damages to which it may be entitled by law, Owner may pursue exemplary damages in an amount (as determined by Owner) which shall not be less than three nor more than ten times the costs Contractor incurs in providing any such gratuities to any such officer or employee.

**19.05**      ***Small, Minority and Women's Businesses***

- A. If Contractor intends to let any subcontracts for a portion of the work, Contractor will take all necessary affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible. Affirmative steps will include:
  - 1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
4. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises;
5. Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

#### **19.06 Anti-Kickback**

- A. Contractor shall comply with the Copeland Anti-Kickback Act (40 USC 3145) as supplemented by Department of Labor regulations (29 CFR Part 3, "Contractors and Subcontractors on Public Buildings or Public Works Financed in Whole or in Part by Loans or Grants of the United States"). The Act provides that Contractor or subcontractor shall be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public facilities, to give up any part of the compensation to which they are otherwise entitled. Owner shall report all suspected or reported violations to Agency.

#### **19.07 Clean Air Act (42 U.S.C. 7401-7671q.) and the Federal Water Pollution Control Act (33 U.S.C. 1251-1387), as amended**

- A. Contractor to agree to comply with all applicable standards, orders or regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401-7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251-1387). Violations must be reported to the federal awarding agency and the Regional Office of the Environmental Protection Agency (EPA).

#### **19.08 Equal Employment Opportunity**

- A. The Contract is considered a federally assisted construction contract. Except as otherwise provided under 41 CFR Part 60, all contracts that meet the definition of "federally assisted construction contract" in 41 CFR Part 60-1.3 must include the equal opportunity clause provided under 41 CFR 60-1.4(b), in accordance with Executive Order 11246, "Equal Employment Opportunity" (30 FR 12319, 12935, 3 CFR Part, 1964-1965 Comp., p. 339), as amended by Executive Order 11375, "Amending Executive Order 11246 Relating to Equal Employment Opportunity," and implementing regulations at 41 CFR part 60, "Office of Federal Contract Compliance Programs, Equal Employment Opportunity, Department of Labor."

#### **19.09 Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)**

- A. Contractors that apply or bid for an award exceeding \$100,000 must file the required certification (RD Instruction 1940-Q Exhibit A-1). The Contractor certifies to the Owner and every subcontractor certifies to the Contractor that it will not and has not used federal appropriated funds to pay any person or organization for

influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining the Contract if it is covered by 31 U.S.C. 1352. The Contractor and every subcontractor must also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the Owner. Necessary certification and disclosure forms shall be provided by Owner.

#### **19.10 Environmental Requirements**

- A. When constructing a Project involving trenching and/or other related earth excavations, Contractor shall comply with the following environmental conditions:
1. Wetlands – When disposing of excess, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert wetlands.
  2. Floodplains – When disposing of excess, spoil, or other Construction Materials on public or private property, Contractor shall not fill in or otherwise convert 100-year floodplain areas (Standard Flood Hazard Area) delineated on the latest Federal Emergency Management Agency Floodplain Maps, or other appropriate maps, e.g., alluvial soils on NRCS Soil Survey Maps.
  3. Historic Preservation - Applicants shall ensure that Contractors maintain a copy of the following inadvertent discovery plan onsite for review:
    - a. If during the course of any ground disturbance related to any Project, any post review discovery, including but not limited to, any artifacts, foundations, or other indications of past human occupation of the area are uncovered, shall be protected by complying with 36 CFR § 800.13(b)(3) and (c) and shall include the following:
      - i. All Work, including vehicular traffic, shall immediately stop within a 50 ft. radius around the area of discovery. The Contractor shall ensure barriers are established to protect the area of discovery and notify the Engineer to contact the appropriate RD personnel. The Engineer shall engage a Secretary of the Interior (SOI) qualified professional archeologist to quickly assess the nature and scope of the discovery; implement interim measures to protect the discovery from looting and vandalism; and establish broader barriers if further historic and/or precontact properties, can reasonably be expected to occur.
      - ii. The RD personnel shall notify the appropriate RD environmental staff member, the Federal Preservation Officer (FPO), and State Historic Preservation Office (SHPO) immediately. Indian tribe(s) or Native Hawaiian Organization (NHOs) that have an interest in the area of discovery shall be contacted immediately. The SHPO may require additional tribes or NHOs who may have an interest in the area of discovery also be contacted. The notification shall include an assessment of the discovery provided by the SOI qualified professional archeologist.

- iii. When the discovery contains burial sites or human remains, the Contractor shall immediately notify the appropriate RD personnel who will contact the RD environmental staff member, FPO, and the SHPO. The relevant law enforcement authorities shall be immediately contacted by onsite personnel to reduce delay times, in accordance with tribal, state, or local laws including 36 CFR Part 800.13; 43 CFR Part 10, Subpart B; and the Advisory Council on Historic Preservation's Policy Statement Regarding treatment of Burial Sites, Human Remains, or Funerary Objects (February 23, 2007).
  - iv. When the discovery contains burial sites or human remains, all construction activities, including vehicular traffic shall stop within a 100 ft. radius of the discovery and barriers shall be established. The evaluation of human remains shall be conducted at the site of discovery by a SOI qualified professional. Remains that have been removed from their primary context and where that context may be in question may be retained in a secure location, pending further decisions on treatment and disposition. RD may expand this radius based on the SOI professional's assessment of the discovery and establish broader barriers if further subsurface burial sites, or human remains can reasonably be expected to occur. RD, in consultation with the SHPO and interested tribes or NHOs, shall develop a plan for the treatment of native human remains.
  - v. Work may continue in other areas of the undertaking where no historic properties, burial sites, or human remains are present. If the inadvertent discovery appears to be a consequence of illegal activity such as looting, the onsite personnel shall contact the appropriate legal authorities immediately if the landowner has not already done so.
  - vi. Work may not resume in the area of the discovery until a notice to proceed has been issued by RD. RD shall not issue the notice to proceed until it has determined that the appropriate local protocols and consulting parties have been consulted.
  - vii. Inadvertent discoveries on federal and tribal land shall follow the processes required by the federal or tribal entity.
4. Endangered Species – Contractor shall comply with the Endangered Species Act, which provides for the protection of endangered and/or threatened species and critical habitat. Should any evidence of the presence of endangered and/or threatened species or their critical habitat be brought to the attention of Contractor, Contractor will immediately report this evidence to Owner and a representative of Agency. Construction shall be temporarily halted pending the notification process and further directions issued by Agency after consultation with the U.S. Fish and Wildlife Service.
5. Mitigation Measures – The following environmental mitigation measures are required on this Project: Requirements assigned by the Army Corps of Engineers as listed in the Nationwide Permit attached to the contract documents.

**19.11 Contract Work Hours and Safety Standards Act (40 U.S.C. 3701-3708)**

- A. Where applicable, for contracts awarded by the Owner in excess of \$100,000 that involve the employment of mechanics or laborers, the Contractor will comply with 40 U.S.C. 3702 and 3704, as supplemented by Department of Labor regulations (29 CFR Part 5). Under 40 U.S.C. 3702 of the Act, the Contractor will compute the wages of every mechanic and laborer on the basis of a standard work week of 40 hours. Work in excess of the standard work week is permissible provided that the worker is compensated at a rate of not less than one and a half times the basic rate of pay for all hours worked in excess of 40 hours in the work week. The requirements of 40 U.S.C. 3704 are applicable to construction work and provide that no laborer or mechanic will be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

**19.12 Debarment and Suspension (Executive Orders 12549 and 12689)**

- A. A contract award (see 2 CFR 180.220) must not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), "Debarment and Suspension." SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549.

**19.13 Procurement of recovered materials**

- A. The Contractor will comply with 2 CFR Part 200.322, "Procurement of recovered materials."

**19.14 American Iron and Steel**

- A. Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference applies an American Iron and Steel requirement to this project. All iron and steel products used in this project must be produced in the United States. The term "iron and steel products" means the following products made primarily of iron or steel: lined or unlined pipes and fittings, manhole covers and other municipal castings, hydrants, tanks, flanges, pipe clamps and restraints, valves, structural steel, reinforced precast concrete, and Construction Materials.
- B. The following waivers apply to this Contract:
  - 1. De Minimis,
  - 2. Minor Components,
  - 3. Pig iron and direct reduced iron, and
  - 4. [add project specific waivers as applicable]- NONE.

## EXHIBIT A—SOFTWARE REQUIREMENTS FOR ELECTRONIC DOCUMENT EXCHANGE

Item	Electronic Documents	Transmittal Means	Data Format	Note (1)
a.1	General communications, transmittal covers, meeting notices and responses to general information requests for which there is no specific prescribed form.	Email	Email and PDF	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contractors Submittals (Shop Drawings, "or equal" requests, substitution requests, documentation accompanying Sample submittals and other submittals) to Owner and Engineer, and Owner's and Engineer's responses to Contractor's Submittals, Shop Drawings, correspondence, and Applications for Payment.	Email w/ Attachment	PDF	
a.4	Correspondence; milestone and final version Submittals of reports, layouts, Drawings, maps, calculations and spreadsheets, Specifications, Drawings and other Submittals from Contractor to Owner or Engineer and for responses from Engineer and Owner to Contractor regarding Submittals.	Email w/ Attachment or LFE	PDF	
a.5	Layouts and drawings to be submitted to Owner for future use and modification.	Email w/ Attachment or LFE	DWG	
a.6	Correspondence, reports and Specifications to be submitted to Owner for future word processing use and modification.	Email w/ Attachment or LFE	DOC	
a.7	Spreadsheets and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	EXC	
a.8	Database files and data to be submitted to Owner for future data processing use and modification.	Email w/ Attachment or LFE	DB	
Notes				
(1)	All exchanges and uses of transmitted data are subject to the appropriate provisions of Contract Documents.			
(2)	Transmittal of written notices is governed by Paragraph 18.01 of the General Conditions.			
Key				
Email	Standard Email formats (.htm, .rtf, or .txt). Do not use stationery formatting or other features that impair legibility of content on screen or in printed copies			
LFE	Agreed upon Large File Exchange method (FTP, CD, DVD, hard drive)			
PDF	Portable Document Format readable by Adobe® Acrobat Reader Version [number] or later			
DWG	Autodesk® AutoCAD .dwg format Version [number]			
DOC	Microsoft® Word .docx format Version [number]			
EXC	Microsoft® Excel .xls or .xml format Version [number]			
DB	Microsoft® Access .mdb format Version [number]			



**EXHIBIT B—FORESEEABLE BAD WEATHER DAYS – NOT USED**

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**EXHIBIT C—GEOTECHNICAL BASELINE REPORT SUPPLEMENT TO THE SUPPLEMENTARY  
CONDITIONS – NOT USED**

## EXHIBIT D—USDA-RD SUPPLEMENT TO SUPPLEMENTARY CONDITION

*Notes to User: This exhibit is a checklist that is to be completed by the Owner and/or Engineer to help ensure that all appropriate and necessary information is submitted with the request to USDA. All information presented in waiver requests are subject to evaluation. Waiver requests deliberately containing false information will be rejected.*

### INFORMATIONAL CHECKLIST FOR PROJECT SPECIFIC WAIVER REQUEST

<b>Information</b>	<input type="checkbox"/>
<b>General</b> <ul style="list-style-type: none"><li>• Waiver request includes the following information:<ul style="list-style-type: none"><li>- Description of the foreign and domestic Construction Materials</li><li>- Unit of measure</li><li>- Quantity</li><li>- Price</li><li>- Date that product is needed (e.g. time of delivery or availability)</li><li>- Location of the construction project</li><li>- Name and address of the proposed Supplier</li><li>- A detailed justification for the use of foreign Construction Materials</li></ul></li><li>• Waiver request was submitted according to the instructions in the memorandum</li><li>• Assistance recipient made a good faith effort to solicit bids for domestic Iron and Steel products, as demonstrated by language in requests for proposals, contracts, and communications with the prime</li></ul>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Public Interest Waiver Request</b> <ul style="list-style-type: none"><li>• Applicants and their Engineers will submit a written justification demonstrating definitive impacts on the community if a specified product is not utilized.</li></ul>	<input type="checkbox"/>
<b>Cost Waiver Requests</b> <ul style="list-style-type: none"><li>• Waiver request includes the following information:<ul style="list-style-type: none"><li>- Comparison of overall cost of project with domestic Iron and Steel products to overall cost of project with foreign Iron and Steel products</li><li>- Relevant excerpts from the bid documents used by the Contractors to complete the comparison</li><li>- Supporting documentation indicating that the Contractor made a reasonable survey of the market, such as a description of the process for identifying Suppliers and a list of contacted Suppliers</li></ul></li></ul>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
<b>Availability Waiver Requests</b> <ul style="list-style-type: none"><li>• Waiver request includes the following supporting documentation necessary to demonstrate the availability, quantity, and/or quality of the materials for which the waiver is requested:<ul style="list-style-type: none"><li>- Supplier information or pricing information from a reasonable number of domestic Suppliers indicating availability/delivery date for Construction Materials</li><li>- Documentation of the assistance recipient's efforts to find available domestic sources, such as a description of the process for identifying Suppliers and a list of contacted Suppliers.</li><li>- Date that product is needed (e.g. time of delivery or availability) to provide justification</li><li>- Relevant excerpts from project Drawings, Specifications, and permits indicating the required quantity and quality of Construction Materials</li></ul></li><li>• Waiver request includes a statement from the prime Contractor and/or Supplier confirming the non-availability of the domestic Construction Materials for which the waiver is sought</li><li>• Has the State received other waiver requests for the materials described in this waiver request for comparable projects?</li></ul>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

Exhibit D—USDA-Rural Develop Supplement to the Supplementary Conditions.

EJCDC® C-800, Supplementary Conditions of the Construction Contract.

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Modified to include RD edits from RUS Bulletin 1780-26 (6/16/2020).

## AMERICAN IRON AND STEEL *DE MINIMIS* LIST FORMAT

*Notes to User: This exhibit is an example format for Contractors to use in maintaining a list of items to document the use of the De Minimis waiver of the American Iron and Steel requirements. This list or similar is required to be filled out throughout the construction Contract as needed. The State Engineer may periodically ask to review this information. At the Contract completion, this list, along with all Manufacturers' certifications, are to be given to the Engineer for delivery to the Owner.*

### *DE MINIMIS* COSTING WORKSHEET

Project Name:

Contract Name/# (if more than one):

Contractor (Company Name):

Representative:

Date:

Total Cost of Materials (or Estimated Value at 50% of the Installed Bid Price):

Allowable Total *De Minimis* Costs (5% of all materials)

Total Cost of all *De Minimis* Items:

Remaining Amount Allowed for Future *De Minimis* Items:

*Note: No single De Minimis item can be more than 1% of the total material cost.*

No.	Detailed Description and Manufacturer or Local Source of <i>De Minimis</i> Material	Quantity	Cost Per Item	Total Item Cost
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				

GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE

*Notes to User: This exhibit is the sample General (Prime) Contractor's Certification of Compliance with the American Iron and Steel requirements to be provided by all General (Prime) Contractors to Engineer for delivery to the Owner at Substantial Completion.*

GENERAL (PRIME) CONTRACTOR'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

DATE:

RE: PROJECT NAME  
APPLICANT  
CONTRACT NUMBER

I hereby certify that to the best of my knowledge and belief all Iron and Steel products installed for this project by my company and by any and all subcontractors and Manufacturers my company has contracted with for this project comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or are the subject of a waiver approved by the Secretary of Agriculture or designee.

---

Name of Construction Company (PRINT)

---

By Authorized Representative (SIGNATURE)

---

Title

## MANUFACTURER'S CERTIFICATION OF COMPLIANCE

*Notes to User: This exhibit is the sample Manufacturer's Certification of Compliance with the American Iron and Steel requirements to be provided by all Manufacturers of American Iron and Steel covered items, to be submitted by Contractor to the Engineer with the corresponding Shop Drawing submittal for delivery to the Owner at Substantial Completion.*

EXAMPLE OF A MANUFACTURER'S CERTIFICATION OF COMPLIANCE WITH PROVISIONS OF THE AMERICAN IRON AND STEEL (AIS) REQUIREMENTS OF SECTION 746 OF TITLE VII OF THE CONSOLIDATED APPROPRIATIONS ACT OF 2017 (DIVISION A - AGRICULTURE, RURAL DEVELOPMENT, FOOD AND DRUG ADMINISTRATION, AND RELATED AGENCIES APPROPRIATIONS ACT, 2017) AND SUBSEQUENT STATUTES MANDATING DOMESTIC PREFERENCE

Date:

Company Name:

Company Address:

Subject: American Iron and Steel (AIS) Certification for Project (X), Owner's Name, and Contract Number

I, (company representative), certify that the (melting, bending, galvanizing, cutting, etc.) processes for (manufacturing or fabricating) the following products and/or material shipped or provided for the subject project is in full compliance with the AIS requirement as mandated by Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference. Item, Products and/or Materials, and location of delivery (City, State):

1.

2.

Such processes for AIS took place at the following location:

\_\_\_\_\_  
(City, State)

\_\_\_\_\_  
Authorized Company Representative Signature

Notes: Authorized signature will be Manufacturer's representative, not the material distributor or Supplier. If any of the above compliance statements change while providing materials to this project, please immediately notify the person(s) who is requesting to use your product(s).

## ENGINEER'S CONSTRUCTION CERTIFICATIONS

*Notes to User: This exhibit consists of four statements that will be certified by the Engineer, to be executed and then submitted to the Agency concurrently with the construction Contract Document package. This certification is to be submitted to the Agency prior to Authorization to bid but is not to be included in the bid package.*

PROJECT NAME AND CONTRACT NUMBER: \_\_\_\_\_

ENGINEER'S NAME: \_\_\_\_\_

### ENGINEER'S CERTIFICATION

The final Drawings and Specifications, construction Contract Documents, Bidding Documents (or requests for proposals or other construction procurement documents), and any other final design phase deliverables, comply with all applicable federal requirements, to the best of my knowledge and professional judgment. This includes the following:

☐ initial The Engineers Joint Contract Documents Committee (EJCDC) documents have been used, and all acceptable revisions identified in this Bulletin have been made in accordance with the terms of the license agreement, which states in part that the Engineer "will plainly show all changes to the standard EJCDC text, using 'Track Changes' (redline/strikeout), highlighting, or other means of clearly indicating additions and deletions." Such other means may include attachments indicating changes (e.g. Supplementary Conditions modifying the General Conditions).

☐ initial Any building(s) designed for this Project will comply with the requirements of the Architectural Barriers Act (ABA), the Americans with Disabilities Act (ADA) of 1990, and the Rehabilitation Act.

☐ initial All Iron and Steel products referenced in the Drawings, Specifications, and Bidding Documents for this Project comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference or are the subject of a waiver approved by the Secretary of Agriculture or designee.

☐ initial All Iron and Steel products that will be referenced in the Addenda, executed Contracts, and Change Orders will comply with Section 746 of Title VII of the Consolidated Appropriations Act of 2017 (Division A - Agriculture, Rural Development, Food and Drug Administration, and Related Agencies Appropriations Act, 2017) and subsequent statutes mandating domestic preference, or will be the subject of a waiver approved by the Secretary of Agriculture or designee.

Note: This certification is not intended to be a warranty in any way, but rather the designer's professional opinion that to the best of their knowledge the documents comply.

\_\_\_\_\_  
Engineer signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed name and title

Exhibit D—USDA-Rural Develop Supplement to the Supplementary Conditions.

EJCDC® C-800, Supplementary Conditions of the Construction Contract.

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CERTIFICATE OF OWNER'S ATTORNEY AND AGENCY  
CONCURRENCE

*Notes to User: This exhibit consists of two certificates, on a single page, to be attached to the Contract and signed upon execution. The first is a certificate to be signed by the Owner's attorney and the second is the concurrence to be signed by the State Engineer. This page is to be inserted after the Agreement between Owner and Contractor for Construction Contract (Stipulated Price) (EJCDC C-520, 2018) in the Construction Contract Documents.*

CERTIFICATE OF OWNER'S ATTORNEY

PROJECT NAME:

CONTRACTOR NAME AND CONTRACT NUMBER:

---

I, the undersigned, \_\_\_\_\_, the duly authorized and acting legal representative of \_\_\_\_\_, do hereby certify as follows: I have examined the attached Contract(s) and performance and payment bond(s) and the manner of execution thereof, and I am of the opinion that each of the aforesaid agreements is adequate and has been duly executed by the proper parties thereto acting through their duly authorized representatives; that said representatives have full power and authority to execute said agreements on behalf of the respective parties named thereon; and that the foregoing agreements constitute valid and legally binding obligations upon the parties executing the same in accordance with the terms, conditions, and provisions thereof.

---

---

Name

Date

AGENCY CONCURRENCE

As lender or insurer of funds to defray the costs of this Contract, and without liability for any payments thereunder, the Agency hereby concurs in the form, content, and execution of this Agreement.

---

Agency Representative

Date

---

Name



## SECTION 00910

### SPECIAL PROVISIONS

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### **SP-01 INCORPORATION OF THE ISWPC**

All provisions of the Idaho Standards for Public Works Construction, hereafter collectively referred to as the ISWPC, apply to the project, except where portions of the ISWPC are modified or replaced by the Contract Documents. Any modifications are indicated for a specific subsection, paragraph, sentence, or drawing.

Where a section or instruction does not exist in the applicable Technical Specifications in the Contract Documents, it shall be assumed the work is to be completed in accordance with the appropriate ISWPC Section. Any forms included in the Project Manual will be used in lieu of similarly titled forms in the ISWPC. Measurement and Payment as referenced in the ISWPC does not apply to this project. Payment for an item will only be made if that item is listed as a Bid Item in Section 00400: Bid Form. If an item is listed as a Bid Item, administrative and procedural requirements will be listed in Section 01275: Measurement and Payment. If an item is not listed as a Bid Item, the item is not required or is considered an incidental cost to other Bid Items.

### **SP-02 QUALIFICATIONS OF CONTRACTOR, SUBCONTRACTORS, SUPPLIERS, ETC.**

Provide qualifications for the Contractor and all Subcontractors, Suppliers, or other persons or organizations identified in Technical Specifications per the guidelines in the respective specification sections.

Submit the evidence of qualifications listed in Article 3.01 of the Instructions to Bidders as well as the following additional information.

- A list of at least three (3) jobs successfully completed within the last five (5) years by the Bidder similar in size and scope to the Work, including references for each project.
- The proposed Superintendent's name and resume.
- The general availability of the Bidder to complete the Work within a reasonable timeframe.
- A list of at least five (5) bridge projects successfully completed within the last ten (10) years by the Bidder similar in size and scope to the Work, including references for each project.
- For each Subcontractor, Supplier, or other person or organization listed, include the primary contact and phone number, approximate anticipated monetary value of Work, and a list of similar projects over the past three (3) years.

### **SP-03 SUBSURFACE AND PHYSICAL CONDITIONS**

In the preparation of Drawings and Specifications, the Engineer or Engineer's Consultants relied upon the following reports of exploration and tests of subsurface conditions at the Site:

1. *Geotechnical Engineering Report*. Located in Appendix 1 of this Project Manual

These reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which the Contractor may rely as identified and the above are incorporated therein by reference. Contractor is not entitled to rely upon other information and data utilized by Engineer and Engineer's Consultants in the preparation of Drawings and Specifications.

#### **SP-04 PREBID EXPLORATION/SITE INFORMATION**

There is a non-mandatory pre-bid meeting for the project. All Bidders are strongly encouraged to visit the site of the work and conduct all field investigations at their disposal to become acquainted with the nature of the work. Obtain written authorization from the Owner's utilities, and others who may be directly affected prior to entering the property, conducting field tests, drilling, boring, excavating, or test pumping.

If potential Bidders wish to excavate test pits or bore, the excavations will be limited to the vicinity of those areas that appear on the Drawings to be excavated. Excavations in paved areas will not be allowed without written permission from the Owner. Excavations and borings must be backfilled promptly and in a reasonably uniform manner and graded to the original ground surface line and grade. Backfill in unpaved streets, parking areas, or other areas used by the owner for the operation of the site(s) must be compacted as specified in the Contract Documents and surfaced with four inches of new or existing gravel.

#### **SP-05 PETROLEUM CONTAMINATED SOILS**

There is no indication that the Contractor will encounter petroleum contaminated soils or petroleum contaminated groundwater within the work area. If this occurs during construction, cease work in the area where contamination is discovered until a time and materials change order for the extra work can be agreed upon by the Contractor, Owner, Engineer, and the Idaho DEQ. Proceed with other elements of the project at no additional cost to the Owner in such an event. The work in the affected area will again proceed after a change order is processed. No shutdown time or associated additional costs will be awarded other than those agreed upon in the change order.

#### **SP-06 SPOIL**

Unless otherwise indicated on the Drawings or elsewhere in these specifications, place spoil in the confines of the existing property boundaries or right-of-ways. In areas where confines limit the placement of spoil, the Contractor may have to haul the spoil out of the area until they are ready to backfill. The locations of spoil placement will be discussed at the preconstruction conference and will be subject to approval by the Engineer. The Contractor will be responsible for the disposal of all excess spoil.

No additional payment will be allowed the Contractor for this work. Refer to Section 01275: Measurement and Payment for more information.

#### **SP-07 BEST MANAGEMENT PRACTICES**

The following are general best management practices (BMPs) for the project:

- **Dust Control** – Dust control is to be considered an integral part of the Work. Dust Control shall be provided from the start of construction until the Work is complete. Fugitive dust as a result of construction shall be controlled at all times within the subject properties. The Contractor shall have a water truck available for dust control prior to beginning any construction tasks. Wetting shall be done a minimum of twice per day in dry conditions or at the direction of the Engineer or Owner as required until the final construction activities are completed. Contractor shall be prepared to provide dust control until the final surface restoration is completed. All costs incurred to meet dust control requirements are incidental to other items of the contract and no separate payment shall be made.

- **Road and Parking Lot / Site Cleaning** – It shall be the sole responsibility of the contractor to keep all roads and parking lots / pads free from mud, gravel, cobbles or other contaminants generated as a result of construction activities. It shall be the responsibility of the contractor to clean all foreign matter from roads and parking areas in a reasonable amount of time as determined by the Owner and Engineer. All costs incurred to meet road and parking lot / pad cleaning requirements are incidental to other items of the contract and no separate payment shall be made.
- **Erosion Control Measures** – Temporary erosion and sediment control measures are required for the project as indicated on the Drawings. These may include, but not be limited to, silt fences, ditch check dams, sediment basins, erosion control mats, stabilized construction entrances, temporary diversions, inlet protection, sediment traps, and slope drains. It is the responsibility of the contractor to install and maintain temporary erosion control measures throughout the construction, as outlined in the stormwater and erosion control plans.
- **Noxious Weed Control** – Comply with any and all county noxious weed control requirements. Determine the specific noxious weed control requirements where the project is located before submitting a bid. Equipment and vehicles shall be washed prior to entering the project site to remove vegetation to avoid the spread of weeds, as required by the county. All costs incurred to meet noxious weed control requirements are incidental to other items of the contract and no separate payment shall be made.
- **Failure to Provide Service** – If the contractor fails to provide adequate service on the above listed items, the Owner reserves the right to contract these activities to a third party, the cost of which will be deducted from the contract amount at the time of the next pay request.

#### **SP-08 TEMPORARY DISPOSAL SITE**

To assist with project construction, the Owner has negotiated an agreement with Woods Crushing and Hauling to utilize the existing rock quarry located east of the Colburn Transfer Site for temporary storage of wood debris, tire disposal and Waste Management container storage. The proposed temporary disposal site will be available during project construction as needed by the Contractor. The Contractor must notify the Owner in writing no less than four (4) weeks prior to needing the temporary site to allow the Owner time to notify the public of changes in disposal and allow for the processing and removal of any existing stockpiles of wood or metal waste. The Owner will be responsible for temporary site operations and clean-up. The temporary disposal site drawings are provided in Appendix 2.

#### **SP-09 WATER FOR CONSTRUCTION**

The Contractor is responsible for finding water for each of the sites. Water will not be available on the sites for Contractor's use.

#### **SP-10 SITE RESTORATION**

Site Restoration is an important part of this project. Site Restoration is replacement or reconstruction of site improvements to rights-of-way, easements, public property, and private property that are affected or altered by construction operations, with improvements restored to condition, which is equal to, or better than, that which existed prior to construction operations. These Site Restoration items include but are not limited to; concrete curb and gutter replacement, sidewalk replacement, concrete surfaces, asphalt replacement, gravel restoration, seeding, sod, and irrigation system repair.

Initial restoration (rough grading, temporary aggregate, if necessary, removal of excess excavated material and debris) shall be done each day to the extent necessary to allow the movement of local traffic and permit access to all areas for emergency vehicles. Maintenance of streets, drives, sidewalks, etc. shall be the responsibility of the Contractor (including dust control, grading, stabilization, etc.) until the restoration is complete and has been accepted by the Owner and Engineer. Restoration of each street or section of utility line shall follow the construction in a timely fashion so as to minimize inconvenience to the Owner and the general public. The manner in which this restoration is done by the Contractor will be a determining factor in the approval of partial payment requests.

After utility work is completed on underground utilities and submitted on monthly estimate for payment, complete site restoration for those utility segments before next monthly estimate for payment is submitted, unless extended in writing by Owner and Engineer. If site restoration is not completed, the Contractor's partial payment request may be denied, or additional retainage may be withheld.

For utility work requiring testing or post-installation TV inspection, completion of segment is not considered to include testing or TV inspection. Schedule for completion of site restoration is not determined by completion of testing or TV inspection.

#### **SP-11 IRRIGATION SYSTEM RESTORATION**

The Contractor shall replace, with new materials, all damaged irrigation system components disturbed by construction. All irrigation components shall be replaced with equal or superior products than existing. All components shall match the style and brand of the existing system or Engineer and Owner approved equal. The Contractor shall coordinate with Owner to schedule shutdown of any irrigated areas to be impacted by construction.

The Contractor will be responsible for any lawn or vegetated area damage caused by delayed replacement of the sprinkling equipment. If irrigation system repair and/or replacement are not completed within 14 days, the Contractor's partial payment request may be denied, or additional retainage may be withheld.

#### **SP-12 PRIVATE ACCESS**

At all times during construction, afford property owners access to their property to the highest degree possible. Ensure that businesses will have at least one approach open at all times, if possible, and open closed-off approaches as quickly as possible.

#### **SP-13 LANDSCAPED AREAS**

Repair any landscaped or vegetated areas on private or public land that are scarred or destroyed during construction to an equal or better condition than that prior to the start of construction. This will include removing, replacing and grading topsoil. Replace all landscaped and/or grass areas disturbed during the construction process with a minimum 6-inches of topsoil. Reseed all disturbed areas, private or public, unless otherwise indicated.

No additional payment will be allowed to the Contractor for this work if outside the pay limits depicted in the restoration details or detailed in Section 01275: Measurement and Payment.

#### **SP-14 EXPLORATORY EXCAVATION**

Exploratory excavation is included in the construction contract. Exploratory excavation is for the convenience of the Owner and/or Engineer and will be used when a subsurface condition needs to be determined or verified. Payment for exploratory excavation will be authorized with documentation of Owner authorization (Engineer issued field order). Contractor initiated exploratory excavation that has not been Owner authorized will not be authorized for payment.

The Contractor shall be prepared to provide Owner directed exploratory excavation within 5 working days of receipt of a field order directing exploratory excavation. Owner may issue a stop work order on any work related to the exploratory excavation if Contractor fails to complete directed exploratory excavations within the field order directed time frame. Contractor will not be authorized or granted an adjustment in the contract price and or contract time for a work suspension related to Contractor's failure to meet the time requirements for exploratory excavations. All excavations must be backfilled in a timely manner. Where it is necessary to leave exploratory excavations open overnight, the Contractor must provide all prudent safety precautions to prevent unauthorized access or accident.

#### **SP-15 REMOVAL AND REPLACEMENT OF EXISTING FENCES**

It is the responsibility of the Contractor to coordinate with Owner, prior to removing existing fences, to determine procedures, length of time fence may be removed, and requirements for temporary fencing until permanent fencing is complete.

All fence removed must be reassembled prior to the end of the workday. A secure fence will be required at the end of each workday. The trench under the fencing section must be backfilled at least 20 feet either side of the fence at the end of each workday.

#### **SP-16 STAGING AREA**

Staging areas have been provided as shown or noted on the drawings. Take care to protect, preserve and/or replace objects and structures encountered within the confines of the staging areas, and restore all disturbed areas as close as possible to original condition unless otherwise dictated in these specifications. Security of the staging areas is the responsibility of the Contractor. Because the public will have access to the collection sites during construction, the Contractor may be required to provide signage and/or security fencing of the staging area as necessary to limit unauthorized access.

Storage of construction materials, equipment, and other items pertinent to the construction of the project will be allowed in the staging areas. However, bulk storage of petroleum-based products stored in tanks will not be allowed. At all times, spill kits must be available on-site for any accidental spills of petroleum.

No payment will be allowed to the Contractor for any work, including restoration, with regards to the staging areas.

#### **SP-17 CONFLICTS WITH UTILITIES**

Utilities will be in conflict with certain areas of the project. Utilities and other appurtenances may include but are not limited to the following: culverts; propane or gas mains and services; television cables; telephone lines and pedestals; electrical boxes and lines; streetlights; telephone and power poles; water mains and services; sanitary sewer mains and services or septic systems and holding tanks; and storm drainpipes and inlets.

Utility locations are based on the available information, which has been provided to or discovered by the Engineer. There is no guarantee as to the accuracy and completeness thereof is expressly disclaimed. As outlined in SC-5.05.A.3, the Contractor must check with the Utilities Underground Location Center (Call 811) at least two full working days in advance of the planned work date so that all utilities are located prior to digging.

The Contractor shall coordinate work with all utility companies or private entities that may be affected by the project. For utilities shown on the Drawings, the Contractor shall be responsible for any charges associated with relocating, removing, replacing, crossing, working around, or supporting utilities or otherwise addressing utility conflicts as necessary to conduct construction operations and properly construct the project. The Contractor shall also be solely responsible for any damage to these utilities due to their operations. The Contractor shall work closely with the utilities to ensure their criteria are met and no problems result. For underground utilities not shown on the Drawings, the Contractor shall follow procedures outlined in Article 5.05: Underground Facilities of the General Conditions.

Unless identified as a bid item in the Bid Form, no separate payment will be made for this work, and the Contractor shall figure the cost of such work into other applicable bid items.

#### **SP-18 DEWATERING**

The Contractor is responsible for any dewatering operations that may be necessary to adequately remove water such that construction activities can be completed as specified. Furthermore, the Contractor is responsible for conveyance and disposal of water to surface watercourses. Make all necessary arrangements for infringements across private property and obtain and adhere to any necessary discharge permits from the DEQ.

#### **SP-19 QUALITY CONTROL TESTING AND SURVEY**

Refer to other applicable sections of the Geotechnical Report (Appendix 1) and the Technical Specifications and Drawings for quality control (QC) testing requirements for the Contractor. Complete testing of all components of the project is required to the satisfaction of the Owner and the Engineer. The Contractor is solely responsible for all QC testing.

All QC testing is the responsibility of the Contractor and must be conducted by an Engineer-approved, certified testing laboratory or consultant hired by the Contractor.

Contractor must remedy all defects and performance problems revealed by the testing to the satisfaction of the Engineer at no additional expense to the Owner. The Owner may conduct quality assurance (QA) testing in addition to the Contractor's quality control testing, and in the case of a conflict between the two, the QA testing shall govern.

Owner through the Engineer is providing Special Inspections testing and monitoring as part of code requirements. This testing is within the envelope of all buildings and shall be considered QA testing. Contractor may rely on this testing as part of their QC testing as long as the Contractor does not abuse this system / service. Abuse is considered when Contractor asks for special inspection testing of subgrade, structural backfill, or the like, and the area fails testing more than once. At which point, the Contractor shall be required to perform its own QC testing to ensure it is ready to pass.

Contractor shall perform all survey work required for the project to ensure location specific compliance with the Plans and Specifications for each stage of construction. This includes the before start of



construction surveys, progress surveys for payment and layout control QC, as-built surveys, and any other surveys the Contractor needs to perform their work. Consider all costs associated with this provision as incidental to performance of the work.

#### **SP-20 WINTER SHUTDOWN**

A shutdown due to inclement weather during the winter months may be requested by the Contractor. Indicate the number of calendar days being requested in the original shutdown request. This initial request may be extended during the shutdown period as long as such extension is justifiable and requested at least 14 days prior to the date the original extension was to elapse. Any extension of shutdown will require the Contractor to demonstrate that adequate operations can be maintained throughout the extended period. Shutdown extensions may require operation modifications and approval of the DEQ. Only one winter shutdown will be granted during the project.

The Owner reserves the right to approve or disapprove any shutdown or extension requests. As a condition of approval of a shutdown, close all open excavations, provide for maintaining traffic, and provide for protection of public property at the work site. The Contractor will not be allowed to perform any work during the shutdown period unless prior approval is granted by the Owner. The Contractor is responsible to provide all appropriate safety measures, or as directed by the Owner, to ensure public safety of the construction areas during shut down. The Contractor is responsible for maintaining those safety measures should they be damaged or fall into disrepair for any reason. The Owner may direct the Contractor to take extra safety precautions should the Owner deem it necessary to do so.

#### **SP-21 PERMITS**

The Owner and Engineer will obtain the following permits at no expense to the Contractor. The Contractor will be required to carry out all provisions of these permits as part of this contract.

1. Building Permit with the County.
2. DEQ / Panhandle Health Approval for Solid Waste Improvements through IDAPA 68.01.06

The Contractor is responsible for obtaining all other necessary permits, licenses, agreements, insurance, and approvals required by any government authority or agency for the performance of this work at his own expense. Owner will allow Contractor access, as appropriate and necessary, for obtaining data in regard to permits and, at its own discretion, may assist Contractor, when necessary, in obtaining such permits. These Permits may include but are not limited to the following:

1. Storm Water Discharge Permits. The work requires a Construction General Permits for all sites disturbing one acre or more, and all discharges must be in accordance with the Contractor's submitted Stormwater Pollution Prevention Plan (SWPPP). The Contractor is responsible for preparing and signing a SWPPP and submitting a complete Notice of Intent (NOI) package to the DEQ. The Contractor will be responsible for all fees associated with the permit application.

Implement and comply with the provisions of the NOIs and SWPPP throughout the construction period. If the Contractor elects not to carry out the provisions of the NOI and SWPPP, he/she shall be responsible for any damages or fines the State of Idaho may assess for non-compliance. At the end of the project, the Contractor will be responsible

for signing and submitting completed Notice of Termination (NOT) forms to the DEQ. The Contractor will be responsible for paying any annual SWPPP permit renewal fees until the NOT is issued.

#### **SP-22 TEMPORARY PROJECT SIGNS**

Construct and install a project sign. The sign must acknowledge the Owner, the Engineer, and USDA Rural Development (RD). Submit a proposed sign design in accordance with the referenced conditions for approval. No separate payment will be made for this work. The cost of furnishing and installing the signs will be included in the General Conditions Bid Item for mobilization.

#### **SP-23 EASEMENTS, CONSTRUCTION LIMITS, AND RIGHT-OF-WAY**

Conduct construction operations within the easement, construction limits, and right-of-way limits. Obtain written permission from the adjoining private landowner prior to conducting any operations off the allowed easement. Take care to protect, preserve, and/or replace objects and structures encountered within the confines of the easements and restore all disturbed areas restored to the original condition unless otherwise dictated in these specifications.

#### **SP-24 IMPACT TO/FROM OTHER ENTITIES**

Operations at the transfer sites are overseen by the County with commercial hauling by Waste Management. Additionally, Waste Management operates the existing waste transfer building and areas around the building along with providing long-haul services to truck the waste to their regional landfill.

#### **SP-25 WORKING HOURS**

Regular working hours are defined as an eight-hour period (plus 1 hour lunch allotment) within the bounds of 7:00 AM and 7:00 PM. Work during other hours may be permitted following written approval of the Owner. Contractor shall provide the Engineer a request at least three (3) days prior to working other hours, or in excess of 8 hours per day. Emergency work may be done without prior permission.

#### **SP-26 PROTECTION OF EXISTING BUILDINGS AND INFRASTRUCTURE**

Contractor shall provide sufficient means and methods such as temporary sheet piling to retain site soils adjacent to all existing buildings and infrastructure that could be impacted. In particular, the existing waste transfer building during new wall construction for the new waste transfer building. Contractor's means and methods of shoring and bracing shall be submitted to the Engineer prior to any wall excavation and demolition at the existing waste transfer building.

#### **SP-27 EXISTING SITE AND WASTE TRANSFER BUILDING DESIGN INFORMATION**

There is limited and incomplete design drawings of the existing site and waste transfer building. Those that are available are provided in Appendix 3.

#### **SP-28 UNSCHEDULED EMPLOYMENT OF THE ENGINEER**

Examples of damages for unscheduled employment of the Engineer that will be assessed against the Contractor include, but are not limited to:

- 1) The Contractor working beyond the specified contract time.
- 2) The Contractor working more than 8 hours per day, (or 40 hours per week if four ten-hour shifts are run) or on Saturdays, Sundays, and Federal Holidays.
- 3) The Contractor utilizing material, supplies, or equipment that requires the redesign of the project.
- 4) The Contractor destroying or disturbing baselines benchmarks or reference stakes.
- 5) Failure of the Contractor to maintain acceptable as-built records.
- 6) The review of a fourth or subsequent submittal of a Shop Drawing, sample, or other item requiring approval.
- 7) Additional services required due to the Contractor's failure to pay subcontractors and/or suppliers.
- 8) Retests required by the Engineer of tests that have failed.
- 9) Additional construction administration required by the Engineer as a result of unacceptable work.

Damages for the unscheduled employment of the Engineer may be incurred by the following personnel and will be determined based on the following hourly rates:

<b>Straight Time</b>	
Project Manager	\$211.00/Hour
Project Engineer	\$176.00/Hour
Resident Project Representative (RPR)	\$141.00/Hour
RPR Overtime Rate	\$212.00/Hour
Project Administrator	\$138.00/Hour
Clerical	\$75.00/Hour
Mileage	\$0.85/Mile
Survey Crew (if provided)	\$250.00/Hour
GPS Rental (if provided)	\$250.00/Day
Nuclear Densometer (if provided)	\$30.00/Day

The rates listed herein are subject to changes on January 1<sup>st</sup> of each year.

Out of pocket expenses for materials, equipment, supplies, transportation, lodging, and subsistence will be billed at cost plus ten percent.

Damages for unscheduled employment of the Engineer will be deducted from monthly progress payments and the final payment as the damages are incurred. Damages for unscheduled employment of the Engineer are independent from liquidated damages for delay as described in the agreement.

#### **SP-29 CONTRACTOR EMERGENCY CONTACT**

Provide a primary and secondary 24-hour, 7-day a week emergency contact.

#### **SP-30 NOXIOUS WEEDS**

Comply with all county and contract noxious weed control requirements. Determine the specific noxious weed control requirements where the project is located before submitting a bid. Equipment and vehicles

shall be washed prior to entering the project site to remove vegetation to avoid the spread of weeds, where applicable. All costs incurred to meet noxious weed control requirements are incidental to other items of the contract.

### **SP-31 FIELD OFFICE**

Maintain a suitable field office at the site, which will serve as headquarters for the project Superintendent. Provide a suitable office space within the Contractor's field office for the Engineer's Resident Project Representative (RPR). All communications, drawings, instructions, and other articles will be delivered to the Contractor's field office or to the Contractor's main office as appropriate. Communications delivered to either location will be deemed to have been delivered to the Contractor.

Maintain copies of record drawings, specifications, shop drawings, submittals, and all communications pertinent to the performance of the work at the field office and make them available to the Owner or Engineer for use at all times.

The field office shall be a common facility for use by all personnel engaged in construction activities. The office shall be of sufficient size to accommodate required office personnel and meetings at the Project site. The field office shall be conditioned for comfortable occupancy. Keep office clean and orderly. Furnish and equip offices as follows:

- Provide a meeting area with a table and eight chairs.
- Provide a room of not less than 100 sq. ft. for the RPR's office space with a worktable, desk, and two chairs. The room shall have a door and have a lock for the RPR to secure their belongings.
- Provide an electric heater and air conditioner with thermostat capable of maintaining a uniform indoor temperature of 68 deg F.
- Provide high speed internet service for the RPR.
- If cellular service is not available, provide a landline for the RPR.
- Provide fluorescent light fixtures capable of maintaining average illumination of 20 fc at desk height.
- Provide two 110- to 120-V duplex outlets. Provide ethernet connections at the RPRs desk for internet.
- Provide a restroom in the office or an outside port-a-potty

All bills for the field office are the responsibility of the Contractor. No separate payment will be made for field offices. The cost of field offices will be included in the mobilization Bid Item for the base bid.

### **SP-32 SUBCONTRACT LIMITATIONS**

The Contractor shall not sublet Work that accounts for a total of more than 50% of the Total Contract Price.

### **SP-33 WAGE RATES**

There are no special wage rates for this project such as Davis Bacon.

#### **SP-34 PROGRESS MEETINGS**

The Engineer will schedule and conduct progress meetings at regular intervals to discuss the status of the project. The meetings will be conducted at the project site, and transmitted virtually unless otherwise indicated. The Engineer will prepare the meeting agendas and will distribute the agendas to attendees.

In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

Engineer will summarize the discussions and agreements achieved and will distribute the meeting notes to attendees.

#### **SP-35 COVID-19 JOB SITE PRACTICES**

Contractor must submit a written safety protocol addressing job site practices being implemented to comply with guidance and requirements from the Centers for Disease Control and Prevention (CDC) and federal, state, and local officials in response to COVID-19 concerns. The COVID-19 Job Site Practices must be submitted and on file before the Notice to Proceed will be issued. The Job Site Practices also apply to the Contractor's subcontractors and suppliers delivering products to the jobsite.

At a minimum, the safety protocol and job site practices should include the following items.

- Jobsite practices to comply with recommendations from the CDC and federal, state, and local health organizations regarding, but not limited to, employee hygiene (i.e., frequent hand washing), jobsite cleanliness and sanitation, social distancing, and limiting in person meetings.
- A plan to screen for and manage sick employees.
- Protocols to limit interaction and contact between construction project activities and existing facilities and personnel staffing those facilities.

*Note: The Association of General Contractors (AGC) has resources specifically related to the COVID-19 virus on their website that can be utilized to help develop appropriate safety protocols.*

**END OF SECTION**

# **DIVISION 1**

## **GENERAL REQUIREMENTS**

## SECTION 01010

### SUMMARY OF WORK

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. The Invitation to Bid contains a general description of the project work to be performed under this Contract. The Supplemental Conditions, Special Provisions, *Geotechnical Engineering Report* (refer to Appendix 1 of the Project Manual), and other documents contain additional information necessary to perform the work.

##### 1.2 CONTRACT DOCUMENTS

- A. Portions of the Contract Documents are written in the imperative mode. Except where specifically intended otherwise, the subject of all imperative statements is the Contractor. For example, "Furnish..." means "Contractor shall furnish...", "Provide" means "Contractor shall provide...". For imperatives specifically addressing the Engineer/Owner, see Paragraph 1.02, General Conditions.
- B. Contract Documents are defined in Article 1, Paragraph 1.01.A.13, General Conditions, any supplemental conditions, special provisions, and Article 7 of the Agreement Form.
- C. The Contract Documents are intended to provide the basis for proper completion of the work suitable for the intended use of the Owner. Comply with Article 3, General Conditions. Specifications and Drawings included in these contract documents establish the performance, quality requirements, location and general arrangement of materials and equipment, and establish the minimum standards for quality of workmanship and appearance. Anything not expressly set forth but which is reasonably implied or necessary for proper performance of the project shall be included.
- D. The various portions of the Contract Documents, of which these specifications are a part, are essential parts of the Agreement, and a requirement occurring in any portion or part is binding as though occurring in all. All portions are intended to be complementary and to describe and provide for a complete work as referenced in Article 3, General Conditions. Unless specifically noted otherwise, in the case of discrepancy the following hierarchy shall be observed:
  - 1. Addenda, which will govern over;
  - 2. Special Provisions, which will govern over;
  - 3. Standard Modifications, which will govern over;
  - 4. Supplementary Specifications, which will govern over;
  - 5. Project Drawings, which will govern over;
  - 6. These Specifications and Standard Drawings, which will govern over;
  - 7. Idaho Standards for Public Works Construction (ISPWC), 2020 edition

- E. A requirement mentioned in one part/section of the Contract Documents shall be considered as having been mentioned in all parts/sections.

### 1.3 WORK SEQUENCE

- A. Submit detail schedules as specified in the Contract Documents.
- B. Field verify dimensions indicated on drawings before fabricating or ordering materials. Do not scale drawings.
- C. Notify Engineer/Owner of existing conditions differing from those indicated on the drawings. Comply with Paragraph 5.04, of the General Conditions and any Supplementary Conditions. Verify the existence and location of underground utilities along the route of the proposed work. Omission of an existing or previous abandoned utility location on the Drawings is not to be considered as its nonexistence. Inclusion of existing utility locations on the Drawings is not to be considered as its definite location. Do not remove or alter existing utilities without prior written approval.

### 1.4 CONTRACTOR USE OF PREMISES

- A. Do not park vehicles or equipment or store materials on private property without written permission from the property owner. Provide Engineer/Owner with copy of authorization.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION (NOT USED)**

### **END OF SECTION**



## SECTION 01040

### PROJECT COORDINATION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the required coordination between the Contractor and Owner.

##### 1.2 SUBMITTALS

- A. Coordination work plan for each site.

##### 1.3 UTILITY NOTIFICATION AND COORDINATION

- A. Coordinate the Work with utility companies and Owner. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during Work.

##### 1.4 FACILITY OPERATIONS

- A. Continuous operation of Owner's facilities is of critical importance. Schedule and conduct activities to enable existing facilities and other construction work to operate continuously, unless otherwise specified.
- B. In the event of conflict between construction activities and facility operations and any other construction work, facility operations have priority unless otherwise specified and approved.
- C. Provide alternative access(es) and traffic control to maintain limited disruption to the operations at the sites at all times with coordination and advanced notice given to the Owner and Engineer.
- D. All Contractor's (including subcontractors' and suppliers') vehicles and equipment must use the Contractor's primary access to enter and exit the site. Contractor shall be available at the gate to chaperone their suppliers and deliveries to the project area; unless otherwise approved by the Owner or Engineer.
- E. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of Owner's operations.
- F. When necessary, plan, design, and provide various temporary services, utilities, connections, access, and similar items to maintain continuous operations of Owner's facility.
- G. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents

and after authorization by the Owner. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

- H. Install and maintain bypass facilities and temporary connections required to keep Owner's facility operations online. Sequences other than those specified will be considered upon written request to Owner, provided they afford equivalent continuity of operations.
- I. Do not proceed with Work affecting a facility's operation without obtaining Owner's advance approval of the need for, and duration of, such Work.
- J. Relocation of Existing Facilities:
  - 1. If required, provide complete relocation of existing structures and underground facilities, including any piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
  - 2. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
  - 3. Perform relocations to minimize downtime of existing facilities.
  - 4. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

#### 1.5 ADJACENT FACILITIES AND PROPERTIES

- A. Examination:
  - 1. After Effective Date of the Agreement but before Work at site commences, Contractor, Engineer, and Owner shall make a thorough examination of pre-existing site conditions including existing buildings, structures, and other improvements in vicinity of the site Work, as applicable, which could be damaged by construction operations.
  - 2. Periodic reexamination shall be performed by the Contractor to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.
- B. Documentation:
  - 1. Record and submit documentation of observations made on examination inspections in accordance with Article CONSTRUCTION PHOTOGRAPHS.

#### 1.6 CONSTRUCTION PHOTOGRAPHS

- A. The Contractor shall photographically document all phases of the project Work including preconstruction, construction progress, and post-construction.
- B. Preconstruction and Post-construction:
  - 1. After Effective Date of the Agreement, but before Work at the site commences, and again upon issuance of Substantial Completion, take a minimum of 10 pictures of the construction site and area adjacent to perimeter of construction site.
  - 2. At least weekly, provide 10 pictures of the construction site and area adjacent to perimeter of the construction site to document construction progress.

3. Format: Digital, minimum resolution of 756 by 504 pixels and 24 bit, millions of color.
- C. Digital Images:
1. Archive using a commercially available photograph management system.
  2. Label each storage media with Project and Owner's name, and week and year images were produced.

#### 1.7 REFERENCE POINTS AND SURVEYS

- A. Owner's Responsibilities:
1. Provide control points convenient to Work.
- B. Location and elevation of control point(s) are shown on Drawings.
- C. Contractor's Responsibilities:
1. Provide benchmarks and additional controls required to layout the Work.
  2. In event of discrepancy in data, request clarification before proceeding with Work.

### **PART 2 PRODUCTS (NOT USED)**

### **PART 3 EXECUTION (NOT USED)**

#### 3.1 GENERAL (CUTTING, FITTING, AND PATCHING)

- A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.
- B. Obtain prior written authorization of Owner before commencing Work to cut or otherwise alter existing facilities.
- C. Refinish surfaces to provide an even finish.
- D. Restore existing work, underground facilities, and surfaces that are to remain in completed Work. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.
- E. Fit Work airtight to pipes, sleeves, and other penetrations through surfaces and fill voids.
- F. Remove specimens of installed Work for testing when requested by Owner.

**END OF SECTION**

## **SECTION 01050**

### **FIELD ENGINEERING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. Construction layout.
  - 2. Field engineering.
- B. Related Sections include the following:
  - 1. Division 1 Section "Submittals" for submitting surveys.
  - 2. Division 1 Section "Contract Closeout" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 CONSTRUCTION LAYOUT**

- A. Verification: Before proceeding to layout the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.
- B. General: Engage a land surveyor licensed in the State of Idaho to lay out the Work using accepted surveying practices.
  - 1. Establish benchmarks and control points to set lines and levels.
  - 2. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
  - 3. Inform installers of lines and levels to which they must comply.
  - 4. Check the location, level and plumb, of every major element as the Work progresses.
  - 5. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
  - 6. Close site surveys with an error of closure equivalent to or less than the standard established by authorities having jurisdiction.

- C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and invert elevations.
- D. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

### 3.2 FIELD ENGINEERING

- A. Identification: Owner and Engineer will identify existing benchmarks and/or control points, and property corners to the best of their knowledge. The Contractor will have the ultimate responsibility to locate, recognize and preserve all of these that are encountered.
- B. Retain a licensed land surveyor in Idaho, at the Contractor's expense, to replace any survey corners, property pins, or highway right-of-way monuments removed or damaged during construction.
- C. Reference Points: Locate existing permanent benchmarks and/or control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.
  - 1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Engineer before proceeding.
  - 2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.
- D. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
  - 1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
  - 2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
  - 3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

**END OF SECTION**

## **SECTION 01275**

### **MEASUREMENT AND PAYMENT**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General and Supplementary Conditions and other Division 1- Division 16 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for measurement and payment.
- B. The work has been broken out into a base bid and bid alternate item(s).
- C. The Owner may choose one or a combination of all of the bid alternate(s) for final contracting depending on the bid amounts and the Owner's budget.

##### **1.3 DEFINITIONS**

- A. Unit price is an amount proposed by bidders, stated on the Bid Form, as a price per unit of measurement for materials or services added to or deducted from the Contract Sum by appropriate modification, if estimated quantities of Work required by the Contract Documents are increased or decreased.
- B. Lump Sum is an amount proposed by bidders, stated on the Bid Form, as a price for the entire bid item for work, services, and materials added to or deducted from the Contract Sum by appropriate modification, if the bid item is eliminated from the project. Increases or decreases to the lump sum bid item will be based on the Schedule of Values under an appropriate modification, and as agreed to by the Owner/Engineer and Contractor. Contractor shall provide as a minimum the work required under each lump sum item for their Schedule of Values and payment.

##### **1.4 PROCEDURES**

- A. This project consists of a series of lump sum and unit price items.
- B. Lump sum prices have a unit of one and consist of a host of items related to a specific type of work or administrative component of the project. As noted above, the Schedule of Values shall breakout these items for tracking and possible changes in work. If there are any royalties, they shall be included in the work item.
- C. Unit prices include all necessary material, plus cost for delivery, installation, insurance, overhead, royalties, if applicable, and profit.
- D. Measurement and Payment: The Measurement and Payment sections do not necessarily name all incidental items required to complete the work. The cost of all such incidentals shall be included in the various related items of work. All estimated quantities stipulated

in the Bid Forms or other Contract Documents are approximate and are to be used only as a basis for estimating the probable cost of the work and for the purpose of comparing the proposals submitted for the work. It is understood and agreed that the actual amounts of work performed, and materials furnished under unit price items may differ from such estimated quantities and the payment for such work and materials shall be based on the actual amount of work done and materials furnished in each case.

- E. Engineer will approve the actual quantities and classifications of Unit Price Work performed by the Contractor.
- F. All taxes shall be included in the Bid Items.
- G. List of Bid Items: A list of Bid Items is included at the end of this Section.
- H. Specification Sections referenced in the schedule contain requirements for materials described under each Bid Item. Refer also to the Drawings that are provided for each of the sites.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION (NOT USED)**

## **PART 4 - MEASUREMENT AND PAYMENT**

### **4.1 LIST OF BID ITEMS**

- A. **SCHEDULE A – WASTE TRANSFER BUILDINGS – BASE BID SCHEDULE:**  
This schedule generally includes the work associated with the new Waste Transfer Building (WTB) (including the adjoining auxiliary building [utility room]), rehabilitation of the existing WTB, and associated ancillaries, including but not limited to all site preparation and demolition work; electrical and mechanical systems; water systems; retaining wall; grading, gravel surfacing, and asphalt paving from the southern project limits to the edge of the HHW pad; improvements to the existing operations road leaving the new WTB to the existing operations gate; and all stormwater management and control systems associated with this area of work. Refer to the Plan Sheets showing this schedule of work. This schedule has one bid add alternate item also listed herein.

#### **1. Bid Item No. A1 – GENERAL CONDITIONS**

- a. **Description:** This item covers the costs of all general Contract conditions and administrative items by portion for this schedule of work, including but not limited to, the costs of obtaining the required permits, bonds, and insurance; submittals, project administration, Contract closeout, and all other labor, tools, equipment, materials, and incidentals necessary to complete the work for this Bid Item.
- b. **Unit of Measurement:** Lump Sum (LS)
- c. **Measurement:** Measurement for the GENERAL CONDITIONS will be made as a percentage completed of the lump sum.

- d. Payment: Payment for GENERAL CONDITIONS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

2. Bid Item No. A2 – TEMPORARY FACILITIES AND CONTROLS

- a. Description: This item covers all work for temporary facilities and controls for this schedule of work, including but not limited to, all preparatory work and operations, including those items necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site (mobilization and demobilization); site trailer, temporary electrical, Contractor's quality control throughout the duration of the project; traffic control, coordination with the Owner and the Owner's onsite waste contractor, all survey work (including but not limited to the before-start-of-construction survey, payment surveys, and as-built survey); setup and maintenance of all temporary erosion control measures, temporary utilities, health and safety, and all other labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work for this Bid Item shall be included.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the TEMPORARY FACILITIES AND CONTROLS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for TEMPORARY FACILITIES AND CONTROLS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

3. Bid Item No. A3 – SITE WORK

- a. Description: This item covers site work not already included in the other bid items for this schedule of work.
- b. Work required: Work required includes but is not limited to the following:
  - 1) Site preparation, clearing, and grubbing;
  - 2) Site grading; excavation, general backfill, import fill, and compaction not already included in other items;
  - 3) All associated demolition and removal / disposal (onsite – free of charge; Contractor required to separate metals);
  - 4) Subgrade preparation and structural fill (not including asphalt paving areas or gravel surfacing – see those separate Bid Items where applicable);
  - 5) Eco-blocks;
  - 6) Water lines, hydrants, standpipes, valves, vaults, etc.
  - 7) Contact water tank and gravity drain lines from the two WTBs to the tank;
  - 8) New WTB retaining wall;
  - 9) Any patching / repairing of existing pavement or concrete pads removed or disturbed during construction.



- 10) Furnishing and installing conduit for future site telecommunication and surveillance systems;
  - 11) Yard lighting systems;
  - 12) Coordinating with local power supplier to provide electrical service;
  - 13) Furnishing and installing electrical service and disconnect(s);
  - 14) Furnishing and installing control panels and other site electrical work;
  - 15) Furnishing and installing necessary control transformer(s) and new power poles, where required;
  - 16) All final site stabilization and erosion and sediment controls;
  - 17) Protective bollards (site / yard);
  - 18) Incidental utilities including all trenching, trench backfill; compaction, conduit, pipe, wiring, and restoration;
  - 19) Grade staking and controls not already included in Temporary Facilities and Controls;
  - 20) Testing and cleaning;
  - 21) All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
- c. Unit of Measurement: Lump Sum
  - d. Measurement: Measurement for SITE WORK will be made per lump sum.
  - e. Payment: Payment for SITE WORK will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

4. Bid Item No. A4 – NEW WTB

- a. Description: This item includes a complete, new Waste Transfer Building (WTB), including but not limited to the auxiliary building (utility room) and all structural systems, pre-engineered metal building, footings and foundations, mechanical and plumbing systems, electrical systems, through-sleeves for installing the stationary crane (add alternative) mounting bolts and plates, finishes, metals, eco-blocks, push walls and metal armoring, tunnel scales and reader boards, breezeway cover between the new and existing waste transfer buildings, commissioning and startup of all systems, and all other work and incidentals for a complete NEW WTB not already included in other bid items. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the NEW WTB will be made as a percentage completed of the lump sum.
- d. Payment: Payment for the NEW WTB will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

5. Bid Item No. A5 – EXISTING WTB REHABILITATION

- a. Description: This item includes a rehabilitating of the existing Waste Transfer Building (WTB), including but not limited to demolition work, concrete saw cutting, replacement of the concrete floor, new metal-cladded concrete pushwalls, chute metal armoring, and all other work and incidentals to rehabilitate the existing WTB. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the EXISTING WTB REHABILITATION will be made as a percentage completed of the lump sum.
- a. Payment: Payment for the EXISTING WTB REHABILITATION will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

6. Bid Item No. A6 – EXISTING OPERATIONS ROAD IMPROVEMENTS

- a. This item includes improving the existing Operations Road from the northside opening of the new WTB tunnels to the existing operations gate, including but not limited to demolition work, grading, road widening, structural fill, soil stabilization, etc. to improve the existing operations road not already included in other bid items. Gravel / rock base and asphalt pavement are included in the ASPHALT PAVING Unit Price Item). All other operations road improvements are included in the SITE WORK Lump Sum Item and associated GRAVEL SURFACING or ASPHALT PAVING Unit Price Items. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the EXISTING OPERATIONS ROAD IMPROVEMENTS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for the EXISTING OPERATIONS ROAD IMPROVEMENTS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

7. Bid Item No. A7 – GRAVEL SURFACING

- a. Description: This item includes furnishing, placing, and compacting the gravel surfacing. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.

- b. Unit of Measurement: Measurement for GRAVEL SURFACING will be made on cubic yard (CY) of in-place, compacted material where shown on the Drawings and before and after surveys of the areas to confirm thickness and area. Payment will be at the minimum thickness times the gravel surfacing area.
- c. Payment: Payment for the GRAVEL SURFACING will be made at the contract unit price.

8. Bid Item No. A8 – ASPHALT PAVING

- a. Description: This item includes furnishing and placing the asphalt pavement, including but not limited to saw-cutting and tying into existing asphalt pavement areas, subgrade preparation, geotextile, placing and compacting aggregate base rock, and placing and compacting the asphalt. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Measurement for ASPHALT PAVING will be made on square foot (SF) of asphalt pavement area placed based on as-built survey of the area.
- c. Payment: Payment for the ASPHALT PAVING will be made at the contract unit price.

9. Bid Add Alternative Item A9 – STATIONARY CRANE

- a. Description: This item includes the new stationary (knuckleboom) crane and remote powerpack for the new WTB, including but not limited to furnishing and installing the crane and powerpack, mounting systems, electrical connection, hydraulic systems, commissioning and startup, and all other work and incidentals to install the STATIONARY CRANE not already included in other bid items. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the STATIONARY CRANE will be made as a percentage completed of the lump sum.
- d. Payment: Payment for the STATIONARY CRANE will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

- B. **SCHEDULE B – NEW CFC REMOVAL BUILDING – BID ALTERNATE SCHEDULE:** This schedule generally is associated with the new CFC Removal Building and associated ancillaries, and includes but is not limited to all associated electrical and mechanical systems; demolition of the existing HHW building; grading and paving of the entrance area (from the new HHW pad area to the new main entrance gate);

stormwater management controls and features and all associated site work; and water systems. Refer to the Plan Sheets showing this schedule of work.

1. Bid Item No. B1 – GENERAL CONDITIONS

- a. Description: This item covers the costs of all general Contract conditions and administrative items by portion for this schedule of work, including but not limited to, the costs of obtaining the required permits, bonds, and insurance; submittals, project administration, Contract closeout, and all other labor, tools, equipment, materials, and incidentals necessary to complete the work for this Bid Item.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the GENERAL CONDITIONS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for GENERAL CONDITIONS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

2. Bid Item No. B2 – TEMPORARY FACILITIES AND CONTROLS

- a. Description: This item covers all work for temporary facilities and controls for this schedule of work, including but not limited to, all preparatory work and operations, including those items necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site (mobilization and demobilization); site trailer, temporary electrical, Contractor's quality control throughout the duration of the project; traffic control, coordination with the Owner and the Owner's onsite waste contractor, all survey work (including but not limited to the before-start-of-construction survey, payment surveys, and as-built survey); setup and maintenance of all temporary erosion control measures, temporary utilities, health and safety, and all other labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work for this Bid Item shall be included.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the TEMPORARY FACILITIES AND CONTROLS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for TEMPORARY FACILITIES AND CONTROLS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

3. Bid Item No. B3 – SITE WORK

- a. Description: This item covers site work not already included in the other bid items for this schedule of work.

- b. Work required: Work required includes but is not limited to the following:
- 1) Site preparation, clearing, and grubbing;
  - 2) Site grading; excavation, general backfill, import fill, and compaction;
  - 3) All associated demolition and removal / disposal (onsite – free of charge; Contractor required to separate metals);
  - 4) Subgrade preparation and structural fill (not including asphalt paving areas or gravel surfacing – see those separate Bid Items where applicable);
  - 5) Water lines, hydrants, standpipes, valves, vaults, etc.
  - 6) Any patching / repairing of existing pavement or concrete pads removed or disturbed during construction.
  - 7) Furnishing and installing conduit for future site telecommunication and surveillance systems;
  - 8) Yard lighting systems;
  - 9) Coordinating with local power supplier to provide electrical service;
  - 10) Furnishing and installing electrical service and disconnect(s);
  - 11) Furnishing and installing control panels, backup generator, re-connection underground to the maintenance shop building, and other site electrical work;
  - 12) Furnishing and installing necessary control transformer(s), where required;
  - 13) All final site stabilization and erosion and sediment controls;
  - 14) Pavement markings and striping;
  - 15) Protective bollards (site / yard);
  - 16) Incidental utilities including all trenching, trench backfill; compaction, conduit, pipe, wiring, and restoration;
  - 17) All site/yard reinforced concrete slabs, structural fill, and anchoring the equipment to the pads;
  - 18) Pavement markings and striping;
  - 19) Grade staking and controls not already included in Temporary Facilities and Controls;
  - 20) Testing and cleaning;
  - 21) All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
- c. Unit of Measurement: Lump Sum
- d. Measurement: Measurement for SITE WORK will be made as a percentage completed of the lump sum.
- e. Payment: Payment for SITE WORK will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

4. Bid Item No. B4 – CFC REMOVAL BUILDING

- a. Description: This item includes a complete CFC Removal Building, including but not limited to all structural systems, footings and

foundations, pre-engineered metal building, mechanical systems, electrical systems, finishes, lean-tos, exterior concrete slabs, bollards, commissioning and startup, testing and cleaning, and all other work and incidentals for a complete the CFC REMOVAL BUILDING not already included in other bid items. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the as specified shall be included.

- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the CFC REMOVAL BUILDING will be made as a percentage completed of the lump sum.
- d. Payment: Payment for the CFC REMOVAL BUILDING will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

5. Bid Item No. B5 – GRAVEL SURFACING

- a. Description: This item includes furnishing, placing, and compacting the gravel surfacing. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Measurement for GRAVEL SURFACING will be made on cubic yard (CY) of in-place, compacted material where shown on the Drawings and before and after surface of the areas to confirm thickness and area. Payment will be at the minimum thickness times the gravel surfacing area.
- c. Payment: Payment for the GRAVEL SURFACING will be made at the contract unit price.

6. Bid Item No. B6 – ASPHALT PAVING

- a. Description: This item includes furnishing and placing the asphalt pavement, including but not limited to saw-cutting and tying into existing asphalt pavement areas, subgrade preparation, geotextile, placing and compacting aggregate base rock, and placing and compacting the asphalt. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Measurement for ASPHALT PAVING will be made on square foot (SF) of asphalt pavement area as shown on the Drawings. Area measured by as-built survey.
- c. Payment: Payment for the ASPHALT PAVING will be made at the contract unit price.

7. Bid Item No. B7 – CHAIN LINK FENCING AND GATE

- a. Description: This item includes furnishing and installing the chain link fencing and entrance gate, including all posts, chain link fabric, anchoring, hardware, hinge and gate systems, privacy slats, etc. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Measurement for CHAIN LINK FENCING and GATE will be made on linear foot (LF) basis of chain link fence as shown on the Drawings. Footage measured by as-built survey of the actual installed chain link fencing. The gates are not measured and are incidental to this bid item.
- c. Payment: Payment for the CHAIN LINK FENCING AND GATE will be made at the contract unit price.

C. **SCHEDULE C – NEW HHW FACILITY – BID ALTERNATE SCHEDULE:** This schedule of work general covers the partial build of the new HHW Facility (refer to this schedule bid add alternative for the full buildout of the HHW facility) and associated ancillaries, including the main concrete slab, the recessed concrete slab, prefabricated HHW building (turn-key), electrical service, and incidental site work. Refer to the Plan Sheets showing this schedule of work. This schedule has one bid add alternate item also listed herein.

1. Bid Item No. C1 – GENERAL CONDITIONS

- a. Description: This item covers the costs of all general Contract conditions and administrative items by portion for this schedule of work, including but not limited to, the costs of obtaining the required permits, bonds, and insurance; submittals, project administration, Contract closeout, and all other labor, tools, equipment, materials, and incidentals necessary to complete the work for this Bid Item.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the GENERAL CONDITIONS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for GENERAL CONDITIONS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

2. Bid Item No. C2 – TEMPORARY FACILITIES AND CONTROLS

- a. Description: This item covers all work for temporary facilities and controls for this schedule of work, including but not limited to, all preparatory work and operations, including those items necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site (mobilization and demobilization); site trailer, temporary electrical, Contractor's quality control throughout the duration of the project; traffic control, coordination with the Owner and the Owner's onsite waste contractor, all survey work (including but not limited to the before-start-of-construction survey, payment surveys, and as-built

survey); setup and maintenance of all temporary erosion control measures, temporary utilities, health and safety, and all other labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work for this Bid Item shall be included.

- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the TEMPORARY FACILITIES AND CONTROLS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for TEMPORARY FACILITIES AND CONTROLS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

3. Bid Item No. C3 – SITE WORK

- a. Description: This item covers site work not already included in the other bid items for this schedule of work.
- b. Work required: Work required includes but is not limited to the following:
  - 1) Site preparation, clearing, and grubbing;
  - 2) Site grading; excavation, general backfill, import fill, and compaction;
  - 3) All associated demolition and removal / disposal (onsite – free of charge; Contractor required to separate metals);
  - 4) Subgrade preparation and structural fill (not including asphalt paving areas or gravel surfacing – see those separate Bid Items where applicable);
  - 5) Any patching / repairing of existing pavement or concrete pads removed or disturbed during construction.
  - 6) Furnishing and installing conduit for future site telecommunication and surveillance systems (see electrical);
  - 7) Yard lighting systems;
  - 8) Furnishing and installing electrical service and disconnect(s);
  - 9) Site electrical work;
  - 10) Protective bollards (site / yard);
  - 11) Incidental utilities including all trenching, trench backfill; compaction, conduit, pipe, wiring, and restoration;
  - 12) Unloading and anchoring of the Haz Waste locker building to the concrete pad;
  - 13) Grade staking and controls not already included in Temporary Facilities and Controls;
  - 14) Testing and cleaning;
  - 15) All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
- c. Unit of Measurement: Lump Sum
- d. Measurement: Measurement for SITE WORK will be made as a percentage completed of the lump sum contract price.



- e. Payment: Payment for SITE WORK will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

4. Bid Item No. C4 – HHW FACILITY (PARTIAL BUILD)

- a. Description: This item includes a partial build of the Household Hazardous Waste (HHW) Facility including but not limited to concrete pads (main and recessed pad), turn-key HHW locker building, electrical connection, bollards, commissioning and startup, testing and cleaning, and all other work and incidentals to complete the HHW FACILITY (PARTIAL BUILD) not already included in other bid items. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the as specified shall be included.
- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the HHW FACILITY (PARTIAL BUILD) will be made as a percentage completed of the lump sum.
- d. Payment: Payment for the HHW FACILITY (PARTIAL BUILD) will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

5. Bid Add Alternative Item C5 – HHW FACILITY (COMPLETE BUILD):

- a. Description: This item includes completing the HHW Facility, including but not limited to the pre-engineered metal building canopy covers (both main and the drive-thru), all structural systems, footings and foundations, slab for the drive-thru, bollards, electrical, testing and cleaning, and all other work and incidentals for the HHW FACILITY (COMPLETE BUILD) not already included in the other associated bid items. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the as specified shall be included.
- b. Unit of Measurement: Lump Sum
- c. Measurement: Measurement for the HHW FACILITY (COMPLETE BUILD) will be made as a percentage completed of the lump sum.
- d. Payment: Payment for the HHW FACILITY (COMPLETE BUILD) will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

D. **SCHEDULE D – NEW OPERATIONS ROAD – BID ALTERNATE SCHEDULE:**  
This schedule generally covers the construction of the new operations road and associated ancillaries. Refer to the Plan Sheets showing this schedule of work.

1. Bid Item No. D1 – GENERAL CONDITIONS

- a. Description: This item covers the costs of all general Contract conditions and administrative items by portion for this schedule of work, including

but not limited to, the costs of obtaining the required permits, bonds, and insurance; submittals, project administration, Contract closeout, and all other labor, tools, equipment, materials, and incidentals necessary to complete the work for this Bid Item.

- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the GENERAL CONDITIONS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for GENERAL CONDITIONS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

2. Bid Item No. D2 – TEMPORARY FACILITIES AND CONTROLS

- a. Description: This item covers all work for temporary facilities and controls for this schedule of work, including but not limited to, all preparatory work and operations, including those items necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site (mobilization and demobilization); site trailer, temporary electrical, Contractor's quality control throughout the duration of the project; traffic control, coordination with the Owner and the Owner's onsite waste contractor, all survey work (including but not limited to the before-start-of-construction survey, payment surveys, and as-built survey); setup and maintenance of all temporary erosion control measures, temporary utilities, health and safety, and all other labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work for this Bid Item shall be included.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the TEMPORARY FACILITIES AND CONTROLS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for TEMPORARY FACILITIES AND CONTROLS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

3. Bid Item No. D3 – SITE WORK

- a. Description: This item covers site work not already included in the other bid items for this schedule of work.
- b. Work required: Work required includes but is not limited to the following:
  - 1) Site preparation, clearing, and grubbing;
  - 2) Site grading; excavation, general backfill, import fill, and compaction;

- 3) All associated demolition and removal / disposal (onsite – free of charge; Contractor required to separate metals);
  - 4) Subgrade preparation and structural fill (not including asphalt paving areas or gravel surfacing – see those separate Bid Items where applicable);
  - 5) Eco-blocks (relocated and new, where applicable);
  - 6) Any patching / repairing of existing pavement or concrete pads removed or disturbed during construction.
  - 7) All final site stabilization and erosion and sediment controls;
  - 8) Grade staking and controls not already included in Temporary Facilities and Controls;
  - 9) Testing and cleaning;
  - 10) All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
- c. Unit of Measurement: Lump Sum
  - d. Measurement: Measurement for SITE WORK will be made as a percentage completed of the lump sum.
  - e. Payment: Payment for SITE WORK will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.
4. Bid Item No. D4 – ASPHALT PAVING
- a. Description: This item includes furnishing and placing the asphalt pavement, including but not limited to saw-cutting and tying into existing asphalt pavement areas, subgrade preparation, geotextile, placing and compacting aggregate base rock, and placing and compacting the asphalt. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
  - b. Unit of Measurement: Measurement for ASPHALT PAVING will be made on square foot (SF) of asphalt pavement area as shown on the Drawings. Area measured by as-built survey.
  - c. Payment: Payment for the ASPHALT PAVING will be made at the contract unit price.
5. Bid Item No. D5 – CHAIN LINK GATE
- a. Description: This item includes furnishing and installing the new operations chain link gate, including all posts, chain link fabric, anchoring, hinge and gate systems, etc. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
  - a. Unit of Measurement: Measurement for CHAIN LINK GATE will be made on will be made as a percentage completed of the lump sum.

- b. Payment: Payment for the CHAIN LINK GATE will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

E. **SCHEDULE E – METALS COLLECTION AREA – BID ALTERNATE SCHEDULE:** This schedule generally covers the construction of the metals collection pad and associated ancillaries, including site work, asphalt paving, gravel surfacing, and eco-blocks. Refer to the Plan Sheets showing this schedule of work.

1. Bid Item No. E1 – GENERAL CONDITIONS

- a. Description: This item covers the costs of all general Contract conditions and administrative items by portion for this schedule of work, including but not limited to, the costs of obtaining the required permits, bonds, and insurance; submittals, project administration, Contract closeout, and all other labor, tools, equipment, materials, and incidentals necessary to complete the work for this Bid Item.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the GENERAL CONDITIONS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for GENERAL CONDITIONS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

2. Bid Item No. E2 – TEMPORARY FACILITIES AND CONTROLS

- a. Description: This item covers all work for temporary facilities and controls for this schedule of work, including but not limited to, all preparatory work and operations, including those items necessary for the movement of personnel, equipment, supplies and incidentals to and from the project site (mobilization and demobilization); site trailer, temporary electrical, Contractor's quality control throughout the duration of the project; traffic control, coordination with the Owner and the Owner's onsite waste contractor, all survey work (including but not limited to the before-start-of-construction survey, payment surveys, and as-built survey); setup and maintenance of all temporary erosion control measures, temporary utilities, health and safety, and all other labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work for this Bid Item shall be included.
- b. Unit of Measurement: Lump Sum (LS)
- c. Measurement: Measurement for the TEMPORARY FACILITIES AND CONTROLS will be made as a percentage completed of the lump sum.
- d. Payment: Payment for TEMPORARY FACILITIES AND CONTROLS will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

3. Bid Item No. E3 – SITE WORK

- a. Description: This item covers site work not already included in the other bid items for this schedule of work.
- b. Work required: Work required includes but is not limited to the following:
  - 1) Site preparation, clearing, and grubbing;
  - 2) Site grading; excavation, general backfill, import fill, and compaction;
  - 3) All associated demolition and removal / disposal (onsite – free of charge; Contractor required to separate metals);
  - 4) Subgrade preparation and structural fill (not including asphalt paving areas or gravel surfacing – see those separate Bid Items where applicable);
  - 5) Eco-blocks;
  - 6) Pavement markings / striping;
  - 7) Any patching / repairing of existing pavement or concrete pads removed or disturbed during construction.
  - 8) Grade staking and controls not already included in Temporary Facilities and Controls;
  - 9) Testing and cleaning;
  - 10) All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified.
- c. Unit of Measurement: Lump Sum
- d. Measurement: Measurement for SITE WORK will be made as a percentage completed of the lump sum.
- e. Payment: Payment for SITE WORK will be made on the percentage of work completed according to the Contract price as indicated in the Bid Form and the approved Schedule of Values.

4. Bid Item No. E4 – GRAVEL SURFACING

- a. Description: This item includes furnishing, placing, and compacting the gravel surfacing. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Measurement for GRAVEL SURFACING will be made on cubic yard (CY) of in-place, compacted material where shown on the Drawings and before and after surface of the areas to confirm thickness and area. Payment will be at the minimum thickness times the gravel surfacing area.
- c. Payment: Payment for the GRAVEL SURFACING will be made at the contract unit price.

5. Bid Item No. E5 – ASPHALT PAVING

- a. Description: This item includes furnishing and placing the asphalt pavement, including but not limited to saw-cutting and tying into existing asphalt pavement areas, subgrade preparation, geotextile, placing and compacting aggregate base rock, and placing and compacting the asphalt. All labor, tools, equipment, materials, royalties, and incidentals necessary to complete the work as specified shall be included.
- b. Unit of Measurement: Measurement for ASPHALT PAVING will be made on square foot (SF) of asphalt pavement area as shown on the Drawings. Area measured by as-built survey.
- c. Payment: Payment for the ASPHALT PAVING will be made at the contract unit price.

## **SECTION 01300**

### **SUBMITTALS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for submitting all submittals, including but not limited to, Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- B. Related Sections include the following:
  - 1. Division 1 Section "Quality Control and Quality Assurance" for submitting test and inspection reports and Delegated-Design Submittals.
  - 2. Division 1 Section "Contract Closeout" for submitting final pay applications and O&M Manual
- C. Submittals are categorized into two types: Action Submittals and Informational Submittals, as follows:
  - 1. Action Submittals: Written and graphic information submitted by the Contractor that requires Engineer's responsive action. The following are examples of action submittals:
    - a. Shop drawings
    - b. Product data
    - c. Samples
    - d. Operation and Maintenance Manuals
    - e. Site Usage Plan (Contractor's staging – including trailer sitting and material laydown area)
    - f. Payment application
    - g. Other requirements found within the technical specifications
- D. Informational Submittal: Information submitted by the Contractor that does not require the Engineer's responsive action. Submittals may be rejected for not complying with requirements. The following are examples of informational submittals:
  - 1. Shop Drawing Schedule
  - 2. Progress Schedule
  - 3. Schedule of Submittals
  - 4. Statement of Qualifications
  - 5. Construction Photography and Videography
  - 6. Work Plans
  - 7. Traffic Plans

8. Outage Requests
9. Proposed Testing Procedures
10. Test Records and Reports
11. Vendor Training Outlines/Plans
12. Test and Start-Up Reports
13. Certifications
14. Design Data
15. Manufacturer(s) Instructions
16. Record Drawings
17. Record Shop Drawings
18. Submittals required by laws, regulations and governing agencies
19. Warranties, Insurance and Bonds
20. Contract Close-Out Documents
21. Material Data Safety Sheets
22. Other requirements found within the technical specifications

### 1.3 RELATED WORK

- A. Additional requirements may be specified in the General Conditions for the Contract.
- B. Additional submittal requirements may be specified in the respective technical Specification Sections.

### 1.4 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities in accordance with the General Conditions.
- C. Submittals Schedule: Submit per the General Conditions
- D. Direct Transmittal from Contractor: Engineer will not accept submittals from anyone but the Contractor.
- E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal.
  1. Initial Review: Allow 21 days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
  2. Allow 21 days for processing each resubmittal.
  3. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.



F. Contractor's Responsibilities

1. All submittals shall be clearly identified as follows:
  - a. Date of Submission
  - b. Project Number
  - c. Submittal Number
  - d. Project Name
  - e. Contractor Identification
    - 1) Contractor
    - 2) Supplier
    - 3) Manufacturer
    - 4) Manufacturer or supplier representative
  - f. Identification of Product
  - g. Reference to Contract Drawing
  - h. Reference to Specification Number, Page, and Paragraph
  - i. Reference to applicable standards, such as AWWA, ASTM, ASHTO, etc
  - j. Indication of Contractor's approval
  - k. Contractor's Certification statement
  - l. Identification of deviations or variances from the Contract Documents, if any
  - m. Reference to previous submittal (for resubmittals)
  - n. Made in America (when required by the Contract Documents)
2. Submittals shall be clear and legible, and of sufficient size for legibility and clarity of the presented data
3. Submittal Log. Maintain a log of all submittals. The submittal log shall be kept accurate and up to date. Provide the submittal log to the Engineer, if requested by the Owner or Engineer. This log should include the following items (as applicable):
  - a. Description
  - b. Submittal Number
  - c. Date transmitted to the Engineer
  - d. Date returned to Contractor (from Engineer)
  - e. Status of Submittal (Reviewed/Reviewed and Noted/etc)
  - f. Date of Resubmittal to Engineer and Return from Engineer (if applicable and repeat as necessary)
  - g. Distribution to subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as required.
  - h. Date material released for fabrication
  - i. Projected (or actual) delivery date
4. Numbering System: Utilize the following submittal identification numbering system:
  - a. The first five digits shall be the applicable Specification Section Number.
  - b. The next three digits shall be the sequential number of each separate item or drawing submitted under each Specification Section, in the chronological order submitted, starting at 1.
  - c. The last character shall be the letter R followed by a digit, if a resubmittal is required, starting with 1 and continuing with sequential numbers. A typical submittal number would be as follows:
    - a) 03300-3-R2
    - b) 03300 = Specification section for Concrete.
    - c) 3 = the third different submittal under this Section.

- d) R2 = the third submission (second resubmission) of that particular submittal.
- 5. Variances
  - a. Notify the Engineer in writing, at the time of submittal, of any variations or deviations in the submittals from the requirements of the Contract Documents per the General Conditions.
  - b. Notify the Engineer in writing, at the time of re-submittal (resubmission), of all variations or deviations from previous submission of that particular shop drawing, except those deviations which are the specific result of prior comments from the Engineer.
- 6. Contractor's Certification
  - a. Each submittal shall have affixed to it the following Certification Statement:
    - 1) "Certification Statement: By this statement, I hereby represent that I have met the requirements of subsection 7.16.A of the General Conditions, satisfied the Contractor's obligations under the Contract Documents with respect to Contractor's review of submittals, and that (enter company name) approves the submittal."
  - b. Each submittal shall bear the above Certification Statement on the cover sheet.
  - c. Each certification statement shall be signed and dated by the individual that reviewed and approved the information prior to submitting the documents to the Engineer.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
- H. Use for Construction: Use only final submittals with mark indicating action taken by Engineer in connection with construction.

## **PART 2 - PRODUCTS**

### **2.1 ACTION SUBMITTALS**

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
  - 1. Number of Copies: Submit five hard copies (paper) of each submittal, unless otherwise indicated. Engineer will return two copies. Mark up and retain one returned copy as a Project Record Document.
  - 2. Electronic Submittal: Contractor may, at their option, provide Action Submittals in an electronic format provided the following conditions are met:
    - a. The submittal contains no pages or sheets larger than 24 x 36 inches
    - b. The entire submittal is included in a single file.
    - c. Electronic files are PDF format (with printing enabled).

- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Include the following information, as applicable:
    - a. Dimensions.
    - b. Identification of products.
    - c. Fabrication and installation drawings.
    - d. Roughing-in and setting diagrams.
    - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - f. Shop work manufacturing instructions.
    - g. Templates and patterns.
    - h. Schedules.
    - i. Design calculations.
    - j. Compliance with specified standards.
    - k. Notation of coordination requirements.
    - l. Notation of dimensions established by field measurement.
  2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
  3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 24 by 36 inches (610 by 915 mm).
- C. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Wiring diagrams showing factory-installed wiring.
    - g. Printed performance curves.
    - h. Operational range diagrams.
    - i. Mill reports.
    - j. Standard product operating and maintenance manuals.
    - k. Compliance with recognized trade association standards.
    - l. Compliance with recognized testing agency standards.
    - m. Application of testing agency labels and seals.
    - n. Notation of coordination requirements.
- D. Samples: Furnish samples required by the Contract Documents for the Engineer's approval. Samples shall be delivered to the Engineer as specified or directed. Unless specified otherwise, provide at least two samples of each required item. Materials or equipment for which samples are required shall not be used in the work unless and until approved by Engineer.
1. Preparation: Include the following information, as applicable:

- a. Physical examples of the work
  - b. Small cuts or containers of materials
  - c. Complete units of repetitively used products
  - d. Color/texture/patterns swatches
  - e. Specimens for coordination of visual effects, graphic symbols, and other specified units of work
- E. Operation and Maintenance Manuals
  - 1. Submit in assembled manuals as specified in Division 1 Section "Contract Closeout". Such manuals shall include detailed instructions for Owner personnel on safe operation procedures, controls, start-up, shut-down, emergency procedures, storage, protection, lubrication, testing, trouble-shooting, adjustments, repair procedures, and other maintenance requirements.
- F. Site Usage Plan
  - 1. Submit a proposed site staging plan, including but not limited to the location of office trailers, storage trailers and material laydown. Such plan shall be a graphic presentation (drawing) of the proposed locations; and, shall include on-site traffic modifications, and temporary utilities, as may be applicable.
- G. Payment Application
  - 1. If an application form is included in the Contract Documents, use that form unless otherwise approved by the Engineer and Owner. If an application form is not included in the Contract Documents, Contractor may prepare a form for approval.

## 2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
  - 1. Number of Copies: Submit two copies of each submittal, unless otherwise indicated. Engineer will not return copies.
  - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
  - 3. Test and Inspection Reports: Comply with requirements in Division 1 Section "Quality Control and Quality Assurance."
  - 4. Electronic Submittal: Contractor may, at their option, provide Action Submittals in an electronic format provided the following conditions are met:
    - a. The submittal contains no pages or sheets larger than 24 x 36 inches
    - b. The entire submittal is included in a single file.
    - c. Electronic files are PDF format (with printing enabled).
- B. Shop Drawing Schedule
  - 1. Prepare and submit a schedule indicating when shop drawings are required to be submitted to support the as-planned construction schedule. The submittal schedule shall allow sufficient time for preparation and submittal, review and response, and fabrication and delivery to support the construction schedule.

- C. Progress Schedule
  - 1. Prepare and submit construction schedules and monthly status reports as specified.
- D. Schedule of Submittals
  - 1. Prepare and submit schedule of submittals as specified in the General Conditions.
- E. Statements of Qualifications
  - 1. Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.
- F. Construction Photography and Videography
  - 1. Provide periodic construction photographs and videography as specified – including but not limited to preconstruction photographs and/or video, monthly progress photos and/or video and post-construction photographs and/or video.
- G. Work Plans
  - 1. Prepare and submit copies of all work plans needed to demonstrate to the Owner that Contractor has adequately thought-out the means and methods of construction and their interface with existing facilities. Work plans and follow-up preparatory meetings shall be conducted for all major work items. All parties involved in the construction of that work item shall attend preparatory meeting.
- H. Traffic Plans
  - 1. Prepare traffic plans where and when required by the Contract Documents and local ordinances or regulations. If Contractor is not already knowledgeable about local ordinances and regulations regarding traffic requirements, become familiar with such requirements and include all costs for preparation and submittal of traffic management plan, as specified. In addition, unless a supplemental payment provision is provided in the bid form, include the cost of all police attendance, when required.
- I. Outage Requests
  - 1. Provide sufficient notification of any outages required (electrical, flow process, etc.) as may be required to tie-in new work into the existing facilities. Unless specified otherwise elsewhere, a minimum of seven calendar days notice shall be provided.
- J. Proposed Testing Procedures
  - 1. Prepare and submit testing procedures proposed to perform testing required by the various technical specifications.
- K. Test Records and Reports
  - 1. Provide copies of all test records and reports as specified in the various technical specifications.
  - 2. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
  - 3. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of

tests performed before installation of product, for compliance with performance requirements.

4. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
5. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
6. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
7. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
  - a. Name, address, and telephone number of factory-authorized service representative making report.
  - b. Statement on condition of substrates and their acceptability for installation of product.
  - c. Statement that products at Project site comply with requirements.
  - d. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  - e. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  - f. Statement whether conditions, products, and installation will affect warranty.
  - g. Other required items indicated in individual Specification Sections.

L. Vendor Training Outlines/Plans

1. At least two weeks before scheduled training of Owner's personnel, provide lesson plans for vendor training in accordance with the specification for O&M manuals.

M. Test and Start-up Reports

1. Manufacturer(s) shall perform all pre-start-up installation inspection, calibrations, alignments, and performance testing as specified in the respective technical specifications. Provide copies of all such test and start-up reports.

N. Certifications

1. Provide various certifications as required by the technical specifications. Such certifications shall be signed by an officer (of the firm) or other individual authorized to sign documents of behalf of that entity.
2. Certifications may include, but are not limited to:
  - a. Welding certifications and welders qualifications
  - b. Certifications of Installation, Testing and Training for all equipment
  - c. Material Testing reports furnished by an independent testing firm
  - d. Certifications from manufacturer(s) for specified factory testing

- e. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.
  - f. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
  - g. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
  - h. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- O. Design Data
- 1. Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- P. Manufacturer(s) Instructions
- 1. Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
    - a. Preparation of substrates.
    - b. Required substrate tolerances.
    - c. Sequence of installation or erection.
    - d. Required installation tolerances.
    - e. Required adjustments.
    - f. Recommendations for cleaning and protection.
- Q. Record Drawings
- 1. No later than Substantial Completion, submit a record of all changes during construction not already incorporated into drawings – in accordance with Division 1 Contract Closeout.
- R. Record Shop Drawings
- 1. Before final payment is made, furnish one set of record shop drawings to the Engineer. These record shop drawings shall be in conformance with the approved documents and should show any field conditions which may affect their accuracy.
- S. Submittals required by laws, regulations and governing agencies
- 1. Prepare and submit all documentation required by state or local law, regulation or government agency directly to the applicable agency. This includes, but is not limited to, notifications, reports, certifications, certified payroll (for projects subject to wage requirements) and other documentation required to satisfy all requirements. Provide to Engineer one hard copy or electronic copy of each submittal made in accordance with this paragraph.

- T. Warranties, Insurance Certificates and Bonds
  - 1. Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
  - 2. Assemble a booklet or binder of all warranties and bonds as specified in the various technical specifications and in accordance with the Division 1 Contract Closeout. Provide two originals to the Engineer.
- U. Contract Close-Out Documents
  - 1. Submit documentation as indicated in Division 1 Contract Closeout.
- V. Material Safety Data Sheets
  - 1. Submit information directly to Owner. If submitted to Engineer, Engineer will not review this information but will return it with no action taken.
- W. Other requirements of the technical Specification Sections
  - 1. Comply with all other requirements of the technical specification sections.

## **PART 3 - EXECUTION**

### **3.1 CONTRACTOR'S REVIEW**

- A. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work or other related Sections, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities.
- B. Before submission to the Engineer, review shop drawings as follows:
  - 1. Make corrections and add field measurements, as required
  - 2. Use any color for its notations except red (reserved for the Engineer's notations) and black (to be able to distinguish notations on black and white documents)
  - 3. Include Contractor's Certification statement
  - 4. Provide field measurements (as needed)
  - 5. Coordinate with other submittals
  - 6. Indicate relationships to other features of the work
  - 7. Highlight information applicable to the work and/or delete information not applicable to the work

### **3.2 ENGINEER'S ACTION**

- A. General: Engineer will not review submittals that do not bear required certification statement, signature, and date of the responsible person and will return them without action.
- B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or modifications required, and return it. Engineer will stamp each submittal



with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

1. “Reviewed” – This code is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.
  2. “Reviewed and Noted” – This code is assigned when a confirmation of notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.
  3. “Revise and Resubmit” – This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the entire package. This resubmittal is to address all comments, omissions and non-conforming items that were noted.
- C. Informational Submittals: Engineer will review each submittal and will not return it, or will reject and return it if it does not comply with requirements.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

#### **END OF SECTION**

## **SECTION 01320**

### **CONSTRUCTION PROGRESS DOCUMENTATION**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
  - 1. Preliminary Construction Schedule.
  - 2. Contractor's Progress Schedule.
  - 3. Submittals Schedule.
  - 4. Daily construction reports.
- B. Related Sections include the following:
  - 1. Special Provisions "Progress Meetings" for submitting and distributing meeting and conference minutes.
  - 2. Division 1 Section "Submittals" for submitting schedules and reports.
  - 3. Division 1 Section "Quality Control and Quality Assurance" for submitting a schedule of tests and inspections.
  - 4. Division 1 Section "Contract Closeout" for submitting Project Record Documents at Project closeout.

##### **1.3 DEFINITIONS**

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
  - 1. Critical activities are activities on the critical path. They must start and finish on the planned early start and finish times.
  - 2. Predecessor activity is an activity that must be completed before a given activity can be started.
- B. Event: The starting or ending point of an activity.
- C. Float: The measure of leeway in starting and completing an activity.
  - 1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
  - 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the following activity.

- 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.
- D. Fragnet: A partial or fragmentary network that breaks down activities into smaller activities for greater detail.
- E. Milestone: A key or critical point in time for reference or measurement.
- F. Network Diagram: A graphic diagram of a network schedule, showing activities and activity relationships.

#### 1.4 SUBMITTALS

- A. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Engineers and owners, and other information specified.
- B. Preliminary Construction Schedule: Submit two printed copies; one a single sheet of reproducible media, and one a print.
- C. Contractor's Construction Schedule: Submit two printed copies of initial schedule, one a reproducible print and one a blue- or black-line print, large enough to show entire schedule for entire construction period.
- D. Daily Construction Reports: Submit 2 copies at monthly intervals.

#### 1.5 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Progress Schedule, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
  - 1. Secure time commitments for performing critical elements of the Work from parties involved.
  - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

### PART 2 - PRODUCTS

#### 2.1 CONTRACTOR'S PROGRESS SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Substantial Completion.
  - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
  3. Submittal Review Time: Include review and resubmittal times indicated in Division 1 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
  4. Startup and Testing Time: Include time for startup and testing.
  5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer's administrative procedures necessary for certification of Substantial Completion.
- B. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
- C. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- D. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using fragnets to demonstrate the effect of the proposed change on the overall project schedule.

## 2.2 PRELIMINARY CONSTRUCTION SCHEDULE

- A. Bar-Chart Schedule: Submit preliminary horizontal bar-chart-type construction schedule at the preconstruction conference.
- B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for construction. Include cash requirement prediction based on indicated activities.

## 2.3 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
  2. List of separate contractors at Project site.
  3. Approximate count of personnel at Project site.
  4. High and low temperatures and general weather conditions.
  5. Accidents.
  6. Meetings and significant decisions.
  7. Daily work progress.
  8. Unusual events (refer to special reports).
  9. Stoppages, delays, shortages, and losses.
  10. Meter readings and similar recordings.
  11. Emergency procedures.

12. Orders and requests of authorities having jurisdiction.
13. Change Orders received and implemented.
14. Work Change Directives received.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial Completions and occupancies.
18. Substantial Completions authorized.

## **PART 3 - EXECUTION**

### **3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE**

- A. Contractor's Progress Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Progress schedule shall be submitted to the Engineer monthly with the progress payment.
  1. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
  2. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
  1. Post copies in Project meeting rooms and temporary field offices.
  2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

**END OF SECTION**

## **SECTION 01340**

### **REQUESTS FOR INFORMATION (RFI)**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings, Technical Specifications, Addenda, and general provisions of the Contract, including Contract General Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section contains the procedures to be followed by Contractor for submitting a Request for Information (RFI) upon discovery of any apparent conflicts, omissions, or errors in the Contract Documents or Drawings or upon having any question concerning Information.
- B. RFI Administrative Requirements
- C. RFI Procedures
- D. RFI Execution
- E. RELATED SECTIONS
  - 1. Division 1 Section "Product Requirements" for product options, substitutions, omissions, and improper descriptions.

##### **1.3 DEFINITIONS**

- A. Request for Information: A document submitted by the Contractor requesting clarification of a portion of the Contract Documents, hereinafter referred to as an RFI.

##### **1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Description: Section provides procedure for Contractors to obtain interpretation or clarification of the Contract Documents, or identify apparent conflicts, omissions, or errors in the Contract Documents.
- B. Responsible Person for Contractor: Submit name of the individual authorized to receive Requests for Information documents, and who is responsible for forwarding Request.
- C. RFI Format: Submit all Requests for Information on the form attached at the back of this Section.

## 1.5 CONTRACTOR'S REQUESTS FOR INFORMATION (RFIs)

- A. Contractor's Requests for Information (RFIs): Should Contractor be unable to determine from the Contract Documents the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of Work is described differently at more than one place in the Contract Documents; the Contractor shall request that the Engineer make an interpretation of the requirements of the Contract Documents to resolve such matters. Contractor shall comply with procedures specified herein to make Requests for Information (RFIs).
- B. Submission of RFIs: RFIs shall be prepared and submitted on a form provided by the Engineer.
1. Forms shall be completely filled in, and if prepared by hand, shall be fully legible after scanning or photocopying.
  2. Each RFI shall be given a discrete, consecutive number starting with 1.
  3. Each page of the RFI and each attachment to the RFI shall bear the following:
    - a. Date of Submission
    - b. Project Number
    - c. Project Name
    - d. RFI Number
    - e. Descriptive Title
  4. Contractor shall sign all RFIs attesting to good faith effort to determine from the Contract Documents the information requested for Information. Frivolous RFIs shall be subject to reimbursement from Contractor to the Owner for fees charged by Engineer, Engineer's consultants and other design professions engaged by the Owner.
- C. Subcontractor-Initiated and Supplier-Initiated RFIs: RFIs from subcontractors and material suppliers shall be submitted through, be reviewed by and be attached to an RFI prepared, signed and submitted by Contractor. RFIs submitted directly by subcontractors or material suppliers will be returned unanswered to the Contractor.
1. Contractor shall review all subcontractor- and supplier-initiated RFIs and take actions to resolve issues of coordination, sequencing and layout of the Work.
  2. RFIs submitted to request clarification of issues related to means, methods, techniques and sequences of construction or for establishing trade jurisdictions and scopes of subcontracts will be returned without Information. Such issues are solely the Contractor's responsibility.
  3. Contractor shall be responsible for delays resulting from the necessity to resubmit an RFI due to insufficient or incorrect information presented in the RFI.
- D. Unacceptable Uses for RFIs: RFIs shall not be used to request the following:
1. Approval of submittals (use procedure specified in Section 01300 - Submittals)
  2. Approval of substitutions (refer to 01600 - Product Requirements)
  3. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the General Conditions)
  4. Different methods of performing Work than those indicated in the Contract Drawings and Specifications (comply with provisions of the General Conditions).
- E. RFI Log: Contractor shall prepare and maintain a log of RFIs, and at any time requested by the Engineer or Owner, the Contractor shall furnish copies of the log showing all outstanding RFIs.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION (NOT USED)**

- 3.1 Submit per the General Conditions. Additionally, electronic RFI requests will be accepted. Notification time begins from the date stamp of the Engineer's mail or email received date.
- 3.2 Requested Information: Contractor shall carefully study the Contract Documents, in particular to ensure that information sufficient for Information of requirements of the Contract Documents is not included. RFIs that request Information of requirements clearly indicated in the Contract Documents will be returned without Information.
- A. In all cases in which RFIs are issued to request clarification of issues related to means, methods, techniques and sequences of construction, for example, pipe and duct routing, clearances, specific locations of Work shown diagrammatically, apparent interferences and similar items, the Contractor shall furnish all information required for the Engineer or Owner to analyze and/or understand the circumstances causing the RFI and prepare a clarification or direction as to how the Contractor shall proceed.
- B. If information included with this type RFI by the Contractor is insufficient, the RFI will be returned unanswered.
- 3.3 Response Time: Request clarifications or information immediately upon discovery of need. Submit RFI's in a timely manner allowing full response time to avoid impacting Progress Schedule.
- A. Engineer, whose decision will be final, shall resolve issues and respond to questions of Contractor, in most cases, within fourteen (14) days. Actual time may be lengthened for complex issues, or shortened for expedited situations, as mutually agreed in writing.
- B. After submission of an RFI by Contractor and prior to receipt of the RFI response from Engineer, the Contractor proceeds with affected Work at own risk. Any portion of the Work not constructed in accordance with Engineer interpretation, clarification, instruction or decision is subject to removal and replacement at Contractor expense.
- 3.4 Disputed Requirements: In the event the Contractor believes that a clarification by the Engineer results in additional cost or time, Contractor shall comply with the Contract General Conditions.

## **END OF SECTION**



## **SECTION 01370**

### **SCHEDULE OF VALUES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for preparing and submitting a Schedule of Values.
- B. Related Sections include the following:
  - 1. Division 1 Section "Measurement and Payment" for administrative requirements governing use of unit prices.

##### **1.3 SCHEDULE OF VALUES**

- A. In accordance with the General Conditions, submit a preliminary Schedule of Values allocated to the various portions of the Work to the Engineer, within 10 days after the Effective Date of the Agreement.
- B. Upon request of the Engineer, provide supporting documentation to substantiate the correctness of the values.
- C. An unbalanced Schedule of Values providing over payment to Contractor on items of the Work which will be performed early in the schedule will not be accepted.
- D. Revise and resubmit the Schedule of Values until acceptable to Engineer.
- E. The Schedule of Values, when accepted by Engineer, will be used as the basis for the Contractor's Applications for Payment. No Application for Payment will be accepted by Engineer for review until the Schedule of Values is accepted.

##### **1.4 FORMAT AND CONTENT OF SCHEDULE OF VALUES**

- A. Provide a typed schedule on standard 8½" by 11" white paper. The Contractor's standard forms and automated printouts will be considered for approval by Engineer upon Contractor's request.
- B. Identify schedule with:
  - 1. Title and location of project;
  - 2. Engineer and Engineer's project number;
  - 3. Name and address of Contractor;
  - 4. Contract designation; and
  - 5. Date of submission.

- C. List the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- D. Follow the Table of Contents of this Project Manual and the MPWSS as the format for listing component items. Identify each line item with the number and title of the respective major section of the specifications.
- E. For each major line item, list sub-values of major products or operation under the item.
- F. List such items as bond and insurance premiums, temporary construction facilities, monthly field overhead, mobilization, and demobilization separately.
- G. For the various portions of the Work, each item must include a directly proportional amount of the Contractor's overhead and profit.
- H. The sum of all values in the schedule must equal the total Contract Sum.

#### 1.5 SUBSCHEDULE OF MATERIAL VALUES

- A. Submit a Subschedule of Material Values, including unit costs and quantities, for products on which progress payments will be requested for stored materials.
- B. The form of the submittal must parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. Include an allowance for normal waste in the unit quantity for bulk materials.
- D. Break the unit values for the materials into:
  - 1. The cost of material, delivered and unloaded at the site, with taxes paid; and
  - 2. The installation costs, including Contractor's overhead and profit.
- E. The installed unit value multiplied by the quantity listed must equal the cost of that item in the Schedule of Values.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION (NOT USED)**

#### **END OF SECTION**

## **SECTION 01400**

### **QUALITY CONTROL AND QUALITY ASSURANCE**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. This Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality-control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's quality-control procedures that facilitate compliance with the Contract Document requirements.
- C. Requirements for Contractor to provide all quality control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

##### **1.2 RELATED DOCUMENTS**

- A. ISPWC Division 2100, FIELD QC MANUAL.

##### **1.3 DEFINITIONS**

- A. Quality Assurance: Activities, actions, and procedures performed before and during execution of the Work by the Owner or its agency and at the Owner's discretion. Such quality assurance does not relieve Contractor from Contractor's quality control.
- B. Quality Control: Tests, inspections, procedures, and related actions during and after execution of the Work by the Contractor to evaluate that completed construction complies with requirements. Services do not include contract enforcement activities performed by Engineer.
- C. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

#### 1.4 SUBMITTALS

- A. Qualification Data: For testing agencies hired by Contractor demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- B. Reports: Prepare and submit certified written reports that include the following:
  - 1. Date of issue.
  - 2. Project title and number.
  - 3. Name, address, and telephone number of testing agency.
  - 4. Dates and locations of samples and tests or inspections.
  - 5. Names of individuals making tests and inspections.
  - 6. Description of the Work and test and inspection method.
  - 7. Identification of product and Specification Section.
  - 8. Complete test or inspection data.
  - 9. Test and inspection results and an interpretation of test results.
  - 10. Ambient conditions at time of sample taking and testing and inspecting.
  - 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
  - 12. Name and signature of laboratory inspector.
  - 13. Recommendations on retesting and reinspecting.
- C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

#### 1.5 QUALIFICATIONS

- A. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- B. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- C. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- D. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance.

- E. Testing Agency Qualifications: An agency with the experience and capability to conduct testing and inspecting indicated, as documented by ASTM E 548, and that specializes in types of tests and inspections to be performed.

## 1.6 QUALITY ASSURANCE

- A. Owner's independent testing and inspections should they decide to conduct such Work.

## 1.7 QUALITY CONTROL

- A. Contractor shall provide quality-control services specified and required by all authorities having jurisdiction.
  - 1. Contractor shall, engage a qualified testing agency(ies) to perform these quality-control services.
    - a. Contractor shall not employ the same entity engaged by Owner for quality assurance, unless agreed to in writing by Owner.
  - 2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 3. Contractor shall submit a certified written report, in duplicate, of each quality-control service.
  - 4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  - 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- A. Preconstruction Testing: Testing agency shall perform preconstruction testing for compliance with specified requirements for performance and test methods.
  - 1. Provide test specimens and assemblies representative of proposed materials and construction. Provide sizes and configurations of assemblies to adequately demonstrate capability of product to comply with performance requirements.
  - 2. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
  - 3. Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- B. Control of Installation
  - 1. Monitor quality control over suppliers, products, services, site conditions, and workmanship, to produce Work of specified quality.
  - 2. Comply with manufacturers' instructions, including each step in sequence.
  - 3. Examine the areas and conditions where Work is to be performed and notify the Owner of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Owner.
  - 4. Request clarification from Engineer should manufacturers' instructions conflict with Contract Documents. The clarification shall be received prior to proceeding.

5. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
  6. Work shall be performed by persons qualified to produce workmanship of specified quality.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing.
- D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that revised or replaced Work that failed to comply with requirements established by the Contract Documents.
- E. Cooperate with Owner and agencies performing required tests, inspections, and similar for quality assurance services. Notify agency(ies) sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
  2. Incidental labor and facilities necessary to facilitate tests and inspections.
  3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  4. Facilities for storage and field-curing of test samples.
  5. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- F. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 REPAIR AND PROTECTION**

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Sections of these Specifications. Restore patched areas and extend restoration into adjoining areas in a manner that eliminates evidence of patching.
- B. Protect construction exposed by or for quality-control service activities.

- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

**END OF SECTION**

## **SECTION 01500**

### **CONSTRUCTION AND TEMPORARY FACILITIES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities may include, but are not limited to, the following:
  - 1. Sewers and drainage.
  - 2. Water service and distribution.
  - 3. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
  - 4. Heating and cooling facilities.
  - 5. Ventilation.
  - 6. Electric power service.
  - 7. Lighting.
  - 8. Telephone service.
- C. Support facilities may include, but are not limited to, the following:
  - 1. Temporary roads and paving.
  - 2. Dewatering facilities and drains.
  - 3. Project identification and temporary signs.
  - 4. Waste disposal facilities.
  - 5. Field offices.
  - 6. Storage and fabrication sheds.
  - 7. Lifts and hoists.
  - 8. Temporary elevator usage.
  - 9. Temporary stairs.
  - 10. Construction aids and miscellaneous services and facilities.
- D. Security and protection facilities may include, but are not limited to, the following:
  - 1. Environmental protection.
  - 2. Stormwater control.
  - 3. Tree and plant protection.
  - 4. Pest control.
  - 5. Site enclosure fence.
  - 6. Security enclosure and lockup.
  - 7. Barricades, warning signs, and lights.
  - 8. Covered walkways.



9. Temporary enclosures.
  10. Temporary partitions.
  11. Fire protection.
- E. Related Sections include the following:
1. Division 1 Section "Submittals" for procedures for submitting copies of implementation and termination schedule and utility reports.
  2. Division 1 Section "Execution Requirements" for progress cleaning requirements.

### 1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Engineer, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

### 1.4 USE CHARGES

- A. General: Cost or use charges for temporary facilities are not chargeable to Owner or Engineer and shall be included 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.
  5. Personnel of authorities having jurisdiction.
- B. Electric Power Service: Pay electric power service use charges, whether metered or otherwise, for electricity used by all entities engaged in construction activities at Project site.

### 1.5 QUALITY ASSURANCE

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
  2. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## 1.6 PROJECT CONDITIONS

- A. Conditions of Use: 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.

## 1.7 HAUL ROUTES

- A. Obtain Owner approval of haul routes.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Engineer. Provide materials suitable for use intended.
- B. Water: Potable.

### 2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Field Offices: Mobile units or other suitable unit with lockable entrances, operable windows, and serviceable finishes; heated and air conditioned; on foundations adequate for normal loading.
- C. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
  - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- D. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
- E. Drinking-Water Fixtures: Containerized, tap-dispenser, bottled-water drinking-water units, including paper cup supply.
- F. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
  - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.

- 2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.
- G. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- H. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION, GENERAL**

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. General: Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
  - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
  - 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, provide trucked-in services.
  - 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking-water fixtures for contractors use. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
  - 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
  - 3. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
- C. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select

equipment from that specified that will not have a harmful effect on completed installations or elements being installed.

- D. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
  - 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.

### 3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
  - 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
- B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. Locate temporary roads and paved areas within construction limits indicated on Drawings.
  - 1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.
- C. Traffic Controls: Provide temporary traffic controls at junction of temporary roads with public roads. Include warning signs for public traffic and "STOP" signs for entrance onto public roads. Comply with requirements of authorities having jurisdiction.
- D. Be responsible for dust control, providing all equipment and personnel for the work. Furnish Engineer with the name(s) and telephone numbers(s) of the person(s) responsible for dust control during evenings and weekends. If a responsible person cannot be contacted or does not respond, Owner may perform or contract out dust control duties at Contract's expense.
- E. Dewatering Facilities and Drains: Comply with requirements in applicable Division 2 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- F. Project Identification and Temporary Signs: Prepare Project identification and other signs in sizes indicated. Install signs where indicated to inform public and persons seeking entrance to Project. Do not permit installation of unauthorized signs.
  - 1. Engage an experienced sign painter to apply graphics for Project identification signs. Comply with details indicated.
  - 2. Prepare temporary signs to provide directional information to construction personnel and visitors.
  - 3. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of

- preservative-treated wood or steel. The design of the sign and supports is the responsibility of the Contractor.
4. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.

### 3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Stormwater Control: Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Barricades, Warning Signs, and Lights: Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- D. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
  2. Vertical Openings: Close openings of 25 sq. ft. (2.3 sq. m) or less with plywood or similar materials.
  3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load bearing, wood-framed construction.
  4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
- E. Temporary Fire Protection: Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
    - a. Field Offices: Class A stored-pressure water-type extinguishers.
  2. Store combustible materials in containers in fire-safe locations.
  3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
  4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.

### 3.5 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
  - 2. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
  - 1. Materials and facilities that constitute temporary facilities are the property of Contractor. Owner reserves right to take possession of Project identification signs.

#### **END OF SECTION**

## **SECTION 01600**

### **PRODUCT REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes the following administrative and procedural requirements: selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. Related Sections include the following:
  - 1. Division 1 Section "Contract Closeout" for submitting warranties for contract closeout.
  - 2. Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

##### **1.3 DEFINITIONS**

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process, or where indicated as a product substitution, to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. This project is funded by the USDA Rural Development and requires compliance with the AIS.
- C. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

- D. Basis-of-Design Product Specification: Where a specific manufacturer's product is named including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.
- E. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
- F. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

#### 1.4 SUBMITTALS

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form:
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified material or product cannot be provided.
    - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.
    - f. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners.
    - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    - h. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
    - i. Cost information, including a proposal of change, if any, in the Contract Sum.
    - j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.



- k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
  - 3. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
    - a. Form of Acceptance: Field Order or Change Order.
    - b. Use product specified if Engineer cannot make a decision on use of a proposed substitution within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 1 Section "Submittal Procedures." Show compliance with requirements.

## 1.5 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

## 1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
  - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
  - 5. Store products to allow for inspection and measurement of quantity or counting of units.
  - 6. Store materials in a manner that will not endanger Project structure.
  - 7. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 9. Protect stored products from damage.

## 1.7 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
  - 1. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

## PART 2 - PRODUCTS

### 2.1 PRODUCT OPTIONS

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged, and unless otherwise indicated, that are new at time of installation.
  - 1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
  - 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  - 3. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures: Procedures for product selection include the following:
  - 1. Product: Where Specification paragraphs or subparagraphs titled "Product" name a single product and manufacturer, provide the product named.
    - a. Substitutions may be considered.
  - 2. Products: Where Specification paragraphs or subparagraphs titled "Products" introduce a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
    - a. Substitutions may be considered, unless otherwise indicated.
  - 3. Manufacturers: Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
    - a. Substitutions may be considered, unless otherwise indicated.

## 2.2 PRODUCT SUBSTITUTIONS

- A. Timing: Engineer will consider requests for substitution if received by the Engineer within 30 days after the Notice of Award. Requests received after that time may be considered or rejected at discretion of Engineer.
- B. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
  - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - 2. Requested substitution does not require extensive revisions to the Contract Documents.
  - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - 4. Substitution request is fully documented and properly submitted.
  - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
  - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - 7. Requested substitution is compatible with other portions of the Work.
  - 8. Requested substitution has been coordinated with other portions of the Work.
  - 9. Requested substitution provides specified warranty.

## 2.3 COMPARABLE PRODUCTS

- A. Where products or manufacturers are specified by name, submit the following, in addition to other required submittals, to obtain approval of an unnamed product:
  - 1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  - 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  - 3. Evidence that proposed product provides specified warranty.
  - 4. List of similar installations for completed projects with project names and addresses and names and addresses of Engineers and owners, if requested.
  - 5. Samples, if requested.

## PART 3 - EXECUTION (NOT USED)

### END OF SECTION

**SECTION 01700**  
**CONTRACT CLOSEOUT**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Inspection procedures.
  - 2. Project record documents.
  - 3. Final cleaning.
- B. Related Sections include the following:
  - 1. Division 1 Section "Execution Requirements" for progress cleaning of Project site.
  - 2. Divisions 2 through 16 Sections for specific closeout and special cleaning requirements for products of those Sections.

**1.3 SUBSTANTIAL COMPLETION**

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following or list items below that are incomplete in request. Also refer to the General Conditions for additional submittals and procedures for Substantial Completion.
  - 1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
  - 2. Advise Owner of pending insurance changeover requirements in accordance with the General Conditions.
  - 3. Submit specific warranties, Performance bonds, maintenance service agreements, final certifications, and similar documents.
  - 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, damage or settlement surveys, property surveys, and/or similar final record information.
  - 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
  - 7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
  - 8. Submit test/adjust/balance records.

9. Terminate and remove temporary facilities from Project site, construction tools, and similar elements.
  10. Advise Owner of changeover in heat and other utilities.
  11. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
  12. Complete final cleaning requirements, including touchup painting.
  13. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
- B. Inspection: Following the submittal of the preliminary documents described above, inspection of the Work shall be completed in accordance with the General Conditions.

#### 1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment.
  2. Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  4. Submit evidence that bonds shall be in effect until one year after the date when final payment becomes due or until completion of the correction period specified, whichever is later.
  5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Engineer will either proceed with inspection or notify Contractor of unfulfilled requirements.
1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

#### 1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Organize list of areas in sequential order.
  2. Organize items applying to each area by major element.
  3. Include the following information at the top of each page:
    - a. Project name.
    - b. Date.
    - c. Name of Engineer.
    - d. Name of Contractor.
    - e. Page number.

## 1.6 PROJECT RECORD DOCUMENTS

- A. General: Do not use Project Record Documents for construction purposes. Maintain Record Documents in accordance with the General Conditions.
- B. Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is installer, Subcontractor, or similar entity, to prepare the marked-up Record Prints. Record Prints shall, at a minimum, meet the following requirements:
  - 1. Give particular attention to information on concealed elements that cannot be readily identified and recorded later.
  - 2. Accurately record information in an understandable drawing technique.
  - 3. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  - 4. Mark Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. Where Shop Drawings are marked, show cross-reference on Contract Drawings.
  - 5. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at the same location.
  - 6. Mark important additional information that was either shown schematically or omitted from original Drawings.
  - 7. Note Work Change Directive numbers, Change Order numbers, alternate numbers, and similar identification where applicable.
  - 8. Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location. Organize into manageable sets; bind each set with durable paper cover sheets. Include identification on cover sheets.
- C. Miscellaneous Record Submittals: Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## PART 2 - EXECUTION

### 2.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Comply with manufacturer's written instructions.
  - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a 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, broken pipe, sheeting, worn-out parts, rejected materials, concrete, asphalt and other foreign substances.
- b. Remove excess piles of gravel or soil deposited throughout project.
  - c. Final grade in unpaved, graveled, and un-graveled areas with a motor grader.
  - d. Remove all loose rocks, boulders, and coarse gravel pushed into a berm by final grading.
  - e. Restore surface drainage to original condition unless otherwise detailed in the project plans and specifications.
  - f. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
  - g. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
  - h. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - i. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
  - j. Remove debris and surface dust from limited access spaces, including roofs, gutters, downspouts, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
  - k. Sweep concrete floors broom clean in unoccupied spaces.
  - l. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
  - m. Remove labels that are not permanent.
  - n. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
  - o. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
  - p. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
  - q. Replace parts subject to unusual operating conditions.
- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Dispose of waste onsite in coordination with Owner.

#### **END OF SECTION**

## **SECTION 01730**

### **EXECUTION REQUIREMENTS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and Special Provisions of the Contract, including General Conditions and other Division 1 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:
  - 1. General installation of products.
  - 2. Coordination of Owner-installed products.
  - 3. Progress cleaning.
  - 4. Starting and adjusting.
  - 5. Protection of installed construction.
- B. Related Sections include the following:
  - 1. Division 1 Section "Contract Closeout" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 PREPARATION**

- A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Engineer's written permission.



- C. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- D. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

### 3.2 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
  - 1. Make vertical work plumb and make horizontal work level.
  - 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- E. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- F. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
- G. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

### 3.3 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Remove and properly dispose of excess material accumulated from demolition and construction (such as piles of gravel or soil, broken concrete, debris, papers, rejected materials, worn-out equipment parts, etc.) from the project site at the Contractor's expense. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
  - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
  - 2. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F (27 deg C).

3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
  1. Remove liquid spills promptly.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.
- F. Exposed Surfaces: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Cutting and Patching: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
  1. Thoroughly clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
- H. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- I. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- J. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- K. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

### 3.4 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.

- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 1 Section "Quality Requirements."

### 3.5 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

**END OF SECTION**

**SECTION 01780**  
**OPERATION AND MAINTENANCE DATA**

**PART 1      GENERAL**

1.01      SECTION INCLUDES

- A.      Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual specification sections. All equipment regardless of individual specification shall be included the O&M data.

1.02      DEFINITIONS

- A.      Preliminary Data: Initial and subsequent submissions for Engineer's review.
- B.      Final Data: Engineer-accepted data, submitted as specified herein.
- C.      Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

1.03      SEQUENCING AND SCHEDULING

- A.      Equipment and System Data:
  - 1.      Preliminary Data:
    - a.      Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
    - b.      Submit prior to shipment date.
  - 2.      Final Data: Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.
- B.      Materials and Finishes Data:
  - 1.      Preliminary Data: Submit at least 15 days prior to request for final inspection.
  - 2.      Final Data: Submit within 10 days after final inspection.

1.04      DATA FORMAT

- A.      Prepare preliminary and final data in the form of an instructional manual and on electronic media.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover: Identify manual with typed or printed title "OPERATION AND MAINTENANCE DATA" and list:
  - a. Project title.
  - b. Designate applicable system, equipment, material, or finish.
  - c. Identity of separate structure as applicable.
  - d. Identify volume number if more than one volume.
  - e. Identity of general subject matter covered in manual.
4. Spine:
  - a. Project title.
  - b. Identify volume number if more than one volume.
5. Title Page:
  - a. Contractor name, address, and telephone number.
  - b. Subcontractor, Supplier, installer, or maintenance contractor's name, address, and telephone number, as appropriate.
    - 1) Identify area of responsibility of each.
    - 2) Provide name and telephone number of local source of supply for parts and replacement.
6. Table of Contents:
  - a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
  - b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
7. Paper: 20-pound minimum, white for typed pages.
8. Text: Manufacturer's printed data, or neatly typewritten.
9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

C. Electronic Media Format:

1. Portable Document Format (PDF):
  - a. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
  - b. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
  - c. Files to be fully functional and viewable in most recent version of Adobe Acrobat.

## 1.05 SUBMITTALS

### A. Informational:

1. Data Outline: Submit two copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Preliminary Data:
  - a. Submit three copies for Engineer's review.
  - b. If data meets conditions of the Contract:
    - 1) One copy will be returned to Contractor.
    - 2) One copy will be forwarded to Resident Project Representative.
    - 3) One copy will be retained in Engineer's file.
  - c. If data does not meet conditions of the Contract:
    - 1) All copies will be returned to Contractor with Engineer's comments (on separate document) for revision.
    - 2) Engineer's comments will be retained in Engineer's file.
    - 3) Resubmit two copies revised in accordance with Engineer's comments.
3. Final Data: Submit two copies in format specified herein.

## 1.06 DATA FOR EQUIPMENT AND SYSTEMS

### A. Content for Each Unit (or Common Units) and System:

1. Product Data:
  - a. Include only those sheets that are pertinent to specific product.
  - b. Clearly annotate each sheet to:
    - 1) Identify specific product or part installed.
    - 2) Identify data applicable to installation.
    - 3) Delete references to inapplicable information.
  - c. Function, normal operating characteristics, and limiting conditions.
  - d. Performance curves, engineering data, nameplate data, and tests.
  - e. Complete nomenclature and commercial number of replaceable parts.
  - f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
  - g. Spare parts ordering instructions.
  - h. Where applicable, identify installed spares and other provisions for future work (e.g., reserved panel space, unused components, wiring, terminals).
2. As-installed, color-coded piping diagrams.

3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings: Supplement product data with Drawings as necessary to clearly illustrate:
  - a. Format:
    - 1) Provide reinforced, punched, binder tab; bind in with text.
    - 2) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
    - 3) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
    - 4) Identify specification section and product on Drawings and envelopes.
  - b. Relations of component parts of equipment and systems.
  - c. Control and flow diagrams.
  - d. Coordinate Drawings with Project record documents to assure correct illustration of completed installation.
5. Instructions and Procedures: Within text, as required to supplement product data.
  - a. Format:
    - 1) Organize in consistent format under separate heading for each different procedure.
    - 2) Provide logical sequence of instructions for each procedure.
    - 3) Provide information sheet for Owner's personnel, including:
      - a) Proper procedures in event of failure.
      - b) Instances that might affect validity of guarantee or Bond.
  - b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
  - c. Operating Procedures:
    - 1) Startup, break-in, routine, and normal operating instructions.
    - 2) Test procedures and results of factory tests where required.
    - 3) Regulation, control, stopping, and emergency instructions.
    - 4) Description of operation sequence by control manufacturer.
    - 5) Shutdown instructions for both short and extended duration.
    - 6) Summer and winter operating instructions, as applicable.
    - 7) Safety precautions.
    - 8) Special operating instructions.
  - d. Maintenance and Overhaul Procedures:
    - 1) Routine maintenance.
    - 2) Guide to troubleshooting.
    - 3) Disassembly, removal, repair, reinstallation, and re-assembly.
6. Guarantee, Bond, and Service Agreement: In accordance with Section 1700, Contract Closeout.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
  - a. Function, normal operating characteristics, and limiting conditions.
  - b. Performance curves, engineering data, nameplate data, and tests.
  - c. Complete nomenclature and commercial number of replaceable parts.
  - d. Interconnection wiring diagrams, including control and lighting systems.
2. Circuit directories of panelboards.
3. Electrical service.
4. Control requirements and interfaces.
5. Communication requirements and interfaces.
6. List of electrical relay settings, and control and alarm contact settings.
7. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
8. As-installed control diagrams by control manufacturer.
9. Operating Procedures:
  - a. Routine and normal operating instructions.
  - b. Startup and shutdown sequences, normal and emergency.
  - c. Safety precautions.
  - d. Special operating instructions.
10. Maintenance Procedures:
  - a. Routine maintenance.
  - b. Guide to troubleshooting.
  - c. Adjustment and checking.
  - d. List of relay settings, control and alarm contact settings.
11. Manufacturer's printed operating and maintenance instructions.
12. List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit or system, and for components or subunits.
2. Format:
  - a. Use Maintenance Summary Form bound with this Section or electronic facsimile of such.
  - b. Each Maintenance Summary may take as many pages as required.
  - c. Use only 8-1/2-inch by 11-inch size paper.
  - d. Complete using typewriter or electronic printing.



3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
  - a. Data to be consistent with manufacturer's Bill of Materials/Parts List furnished in O&M manuals.
  - b. "Unit" is the unit of measure for ordering the part.
  - c. "Quantity" is the number of units recommended.
  - d. "Unit Cost" is the current purchase price.

## 1.07 DATA FOR MATERIALS AND FINISHES

### A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
  - a. Catalog number, size, and composition.
  - b. Color and texture designations.
  - c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
  - a. Manufacturer's recommendation for types of cleaning agents and methods.
  - b. Cautions against cleaning agents and methods that are detrimental to product.
  - c. Recommended schedule for cleaning and maintenance.

### B. Content for Moisture Protection and Weather Exposed Products:

1. Manufacturer's data, giving full information on products:
  - a. Applicable standards.
  - b. Chemical composition.
  - c. Details of installation.
2. Instructions for inspection, maintenance, and repair.

## 1.08 SUPPLEMENT

### A. The supplement listed below, following "End of Section," is part of this Specification.

1. Maintenance Summary Form.

## **PART 2 PRODUCTS (NOT USED)**

## **PART 3 EXECUTION (NOT USED)**

## **END OF SECTION**

## SECTION 01800

### EQUIPMENT TESTING AND SYSTEM STARTUP

#### PART 1 - GENERAL

##### 1.1 DEFINITIONS

- A. Functional Test: Test or tests in presence of Engineer and/or Owner to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.
- B. Performance Test: Test or tests performed after any required functional test in presence of Engineer and/or Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual specification sections.
- C. Unit Process: As used in this section, a unit process is a portion of the facility that performs a specific process function.
- D. System Performance Demonstration:
  - 1. A demonstration, conducted by Contractor, to demonstrate and document the performance of the operating system, both manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
  - 2. Such demonstration is for the purposes of (i) verifying to Owner system performs as a whole, and (ii) documenting performance characteristics of completed system Owner's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or the responsibility of Contractor, unless such performance is otherwise specified.

##### 1.2 SUBMITTALS

- A. Informational Submittals:
  - 1. System Startup and Performance Demonstration Plan.
  - 2. Functional and performance test results.
  - 3. Completed Unit Process Startup Form for each unit process.
  - 4. Completed system Performance Demonstration/Certification Form.

##### 1.3 STARTUP AND PERFORMANCE DEMONSTRATION PLAN

- A. Develop a written plan, in conjunction with Owner's operations personnel, to include the following:
  - 1. Step-by-step instructions for startup of each unit process and the complete system.
  - 2. Unit Process Startup Form (sample attached), to minimally include the following:
    - a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.

- b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
  - c. Startup requirements for each unit process, including water, power, chemicals, etc.
  - d. Space for evaluation comments.
- 3. Performance Demonstration/Certification Form (sample attached), to minimally include the following:
  - a. Description of unit processes included in the system startup.
  - b. Sequence of unit process startup to achieve system startup.
  - c. Description of computerized operations, if any, included in the facility.
  - d. Contractor certification that system is capable of performing its intended function(s), including fully automatic operation.
  - e. Signature spaces for Contractor and Owner.

## **PART 2 - PRODUCTS (NOT USED)**

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Startup Meeting(s): Meeting(s) to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and Owner involvement.
- B. Contractor's Testing and Startup Representative:
  - 1. Designate and furnish one or more personnel to coordinate and expedite testing and system startup.
  - 2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.
- C. Provide temporary valves, gauges, piping, test equipment, and other materials and equipment required for testing and startup.
- D. Provide Subcontractor(s) and equipment supplier's staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

### **3.2 EQUIPMENT TESTING**

- A. Preparation:
  - 1. Complete installation of all equipment before testing.
  - 2. Furnish qualified supplier representatives.
  - 3. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
    - a. Owner/Project Name.
    - b. Equipment or item tested.
    - c. Date and time of test.
    - d. Type of test performed (Functional or Performance).
    - e. Test method.
    - f. Test conditions.
    - g. Test results.

- h. Signature spaced for Contractor and Owner as witness.
  - 4. Cleaning and Checking: Prior to beginning functional testing:
    - a. Calibrate testing equipment in accordance with manufacturer's instructions.
    - b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
    - c. Lubricate equipment in accordance with manufacturer's instructions.
    - d. Turn rotating equipment by hand when possible, to confirm that equipment is not bound.
    - e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
    - f. Check power supply to electric-powered equipment for correct voltage.
    - g. Adjust clearances and torque.
    - h. Test piping for leaks.
  - 5. Ready-to-test determination will be by Owner based at least on the following:
    - a. Acceptable Operation and Maintenance Data.
    - b. Notification by Contractor of equipment readiness for testing.
    - c. Adequate completion of Work adjacent to, or interfacing with, equipment to be tested.
    - d. Availability and acceptability of suppliers to assist in testing of respective equipment.
    - e. Equipment tagging complete.
    - f. Delivery of all spare parts and special tools.
- B. Functional Testing:
- 1. Notify Owner and Engineer in writing at least 10 calendar days prior to scheduled date of testing.
  - 2. Prepare Equipment Test Report summarizing test method and results.
  - 3. When in Owner's and Engineer's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase. Such acceptance will be evidenced by Engineer's or Owner's signature as witness to Equipment Test Report.
- C. Performance Testing:
- 1. Notify Engineer and Owner in writing at least 10 calendar days prior to scheduled date of test.
  - 2. Performance testing shall not commence until equipment has been accepted by Engineer and Owner as having satisfied functional test requirement specified.
  - 3. Type of fluid, gas, or solid for testing shall be as specified.
  - 4. Furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
  - 5. Prepare Equipment Test Report summarizing test method and results.
  - 6. When in Owner's and Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted. Such acceptance will be evidenced by Engineer's or Owner's signature as witness to Equipment Test Report.

### 3.3 STARTUP OF UNIT PROCESSES

- A. Prior to unit process startup, equipment within unit process shall be accepted by Engineer or Owner as having met functional and performance testing requirements as specified.
- B. Startup sequencing of unit processes shall be as chosen by Contractor to meet schedule requirements.
- C. Make adjustments, repairs, and corrections necessary to complete unit process startup.
- D. Startup shall be considered complete when, in opinion Owner or Engineer, unit process has operated in manner without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.
- E. Significant Interruption: May include any of the following events:
  - 1. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.
  - 2. Failure to meet specified functional operation.
  - 3. Failure of any critical equipment or unit process that is not satisfactorily corrected.
  - 4. Failure of any noncritical equipment or unit process that is not satisfactorily corrected.
  - 5. As determined by Engineer.
- F. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

### 3.4 FACILITY PERFORMANCE DEMONSTRATION

- A. When, in the opinion of Owner or Engineer, startup of all unit processes has been achieved, sequence each unit process to the point that entire system is operational.
- B. Demonstrate proper operation of required interfaces within and between individual unit processes.
- C. After facility is operating, complete performance testing of equipment and systems not previously tested.
- D. Document, as defined in System Startup and Performance Demonstration Plan, the performance of the facility.
- E. Certify, on the System Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic operation.

### 3.5 SUPPLEMENTS

- A. Supplements listed below, following "End of Section," are a part of this Specification:
  - 1. Unit Process Startup Form.
  - 2. System Performance Demonstration/Certification Form.

## END OF SECTION

## UNIT PROCESS STARTUP FORM

OWNER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

Unit Process Description: (include description and equipment number of all equipment and devices):

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Startup Procedure (describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

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Startup Requirements (water, power, chemicals, etc.): \_\_\_\_\_

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Evaluation Comments: \_\_\_\_\_

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## SYSTEM PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER: \_\_\_\_\_

PROJECT: \_\_\_\_\_

Unit Process Description: (list unit processes involved in startup):

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Unit Process Startup Sequence (describe sequence for startup, including computerized operations, if any):

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Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: \_\_\_\_\_

Date \_\_\_\_\_, 20\_\_\_\_

Owner : \_\_\_\_\_

Date \_\_\_\_\_, 20\_\_\_\_

Authorized Signature

# **DIVISION 2**

## **SITE CONSTRUCTION**



## SECTION 02221

### TRENCHING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Trench excavation.
  - 2. Bracing, shoring, and trench protection.
  - 3. Trench stabilization.
  - 4. Trench fill and backfill.
- B. Related Sections include the following:
  - 1. Division 1 Section "Construction and Temporary Facilities" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
  - 2. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.

##### 1.3 DEFINITIONS

- A. General: Refer to Division 2 Section "Earthwork"
- B. Bedding Material: Granular material upon which pipes are placed. Minimum bedding depth as shown on the Drawings.
- C. Pipe Zone: Backfill zone that includes the full trench width and extends from the prepared trench bottom to an upper limit above the outside surface of pipe as shown on the Drawing.
- D. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of pipe bedding material.
- E. Trench Stabilization Material: Backfill material to stabilize the trench bottom if it is not stable.

##### 1.4 SUBMITTALS

- A. Samples, product information, and datasheets for all specified equipment and products herein and shown on the Drawings.
- B. Material Test Reports: Certified test reports from a qualified testing agency for compliance with the specifications.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Materials from Trench Excavation:
  - 1. Backfill material obtained from trench excavations must be free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials to be reused as trench backfill.
- B. Imported Backfill Material:
  - 1. Imported backfill material is from source(s) outside the project limits and is used when, in the opinion of the Engineer, an adequate volume of suitable backfill material is not available within the project limits.

### **2.2 PIPE BEDDING AND PIPE ZONE MATERIALS**

- A. Imported material that is unfrozen and friable, with no clay balls, roots, or other organic matter, trash, cinders, or other deleterious materials.
- B. Pipe bedding for utility trenches shall conform to ISPWC Section 305 – Pipe Bedding.
- C. Pipe zone material shall conform to the Structural Fill and Compaction requirements in accordance with the *Geotechnical Engineering Report*.

### **2.3 TRENCH BACKFILL**

- A. Under pavement or concrete (buildings, pads, etc.): Material above the pipe zone to subgrade shall conform to the Structural Fill and Compaction in accordance with the *Geotechnical Engineering Report*.
- B. Under gravel or topsoil: Material above pipe zone shall be General Fill.

### **2.4 GEOTEXTILES/GEOGRIDS**

- A. Refer to *Geotechnical Engineering Report* (Appendix I of the Project Manual).

### **2.5 BURIED WARNING TAPE**

- A. Buried warning tape shall have a minimum 3-inch width and 5 mil thickness running the full length and width of the trench and color-coded. The tape shall meet APWA/ULCC Color Code requirements.

## 2.6 LOCATING WIRE

- A. Jacketed #12 copper wire shall be used for detection wire for all buried HDPE and PVC pipes. All spliced and repaired wire connections in the tracer wire system shall be made using solderless splice kits. No splices will be allowed for wire lengths less than 500 feet. All tracer wire shall be tested by the Contractor prior to final inspection. Contractor shall notify the Engineer 24 hours in advance of the testing
- B. Locating wire shall conform to ISPWC Section 401 – Water Pipe and Fittings.
- C. Locating Wire Box:
  - 1. Frame and Cover: Rich Series 921 or 926, or equal.
  - 2. Risers: PVC AWWA C 900 sized to fit inside the locating wire box without slipping.
  - 3. Collar: Class 3000 psi concrete.

## 2.7 TRENCH FOUNDATION STABILIZATION MATERIAL

- A. Imported material that is unfrozen and friable, with no clay balls, roots, or other organic matter, trash, cinders, or other deleterious materials.
- B. Crushed stone within maximum particle size of 3-inches, uniformly graded from coarse to fine, and less than 8 percent by weight passing the 1/4-inch sieve. Refer to the *Geotechnical Report* (Appendix 1 of the Project Manual).

# PART 3 - EXECUTION

## 3.1 PROTECTION OF EXISTING PROPERTIES

- A. General:
  - 1. Take precautions to protect all adjoining private and public property and facilities, including underground and overhead utilities, curbs, sidewalks, driveways, structures, and fences. Restore or replace all disturbed or damaged facilities to its original conditions at Contractor's expense.
  - 2. Perform utility locates by a professional company before digging. Provide minimum 2 business days' advanced notice. Coordinate with Owner for known buried utilities.
  - 3. Protect utilities exposed during the work and prevent damaging underground utilities adjacent to excavations. Immediately notify the utility owner of any construction damage. Repairs of damage to marked utilities are at the expense of the Contractor.
  - 4. Relocate existing utilities where and if shown on the plans that conflict with new pipelines or structures.

5. Cut and replace existing service lines interfering with trenching operations only with the Engineer's permission and at the Contractor's expense.
  6. Protect existing water and sewer mains and water and sewer services from freezing at all times during construction.
- B. Existing Structures
1. Prevent damage to existing buildings or structures in the work area. Repair all construction related damage to the satisfaction of the Owner.
- C. Existing Overhead Utilities
1. Use extreme caution to avoid conflict, contact or damage to overhead utilities during the work.
- D. Maintenance of Flows
1. Maintain the flow of sewers, drains and water courses encountered during construction. Restore culverts, ditches, fences and structures disturbed by construction to their original condition upon completion of the work.

### 3.2 TRENCH EXCAVATION

- A. General
1. Excavate at the specified locations for pipeline installations and appurtenant structures.
  2. During excavation, stockpile backfill materials away from the trench banks to assure trench wall stability. Stockpile excavated materials on only one side of the trench without obstructing existing fire hydrants, valves, manholes and other appurtenances. Assure surface drainage of adjoining areas is unobstructed.
  3. Remove and dispose of all excess or unsuitable excavated materials.
  4. Prevent surface water from flowing into excavations. Promptly remove all water accumulating in trench excavations. Do not permit water to accumulate in any open trench. Remove and re-lay all pipe out of alignment or grade caused by trench flooding.
  5. Grade the trench bottoms to the specified lines and grades. Assure bedding material provides uniform bearing and support for each pipe section along its entire length. Excavate for bell and joints after the trench bedding is graded, limiting the excavation to the required length, depth and width needed.
  6. The use of trench digging machinery is permitted, except in places where its operation is likely to cause damage to existing structures or features, in which case hand methods are to be employed.
  7. Perform the work so that trenches will remain open the minimum time required to accomplish the work.
  8. Do not begin trench excavating until appropriate backfill materials, piping, and compaction equipment are onsite.
- B. Trench Dimensions
1. Excavate to the trench dimensions specified below.
  2. Width:
    - a. Excavate to provide room to install and join the pipe. The minimum trench width is the pipe O.D. plus 18 inches, or 24 inches, whichever is greater.

3. Depth:
    - a. Excavate the trench as required for the invert grade or pipe bury as shown on the plans, plus 6 inches for pipe bedding. If bedrock, boulders or large stones are encountered at the bottom of the trench, excavate at least 6 inches below the bottom and install pipe bedding.
  4. Trench Bottom:
    - a. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for pipe bedding. Confirm that subgrade is firm and unyielding.
    - b. Soft or Unsuitable Subgrade: When soft or unstable material is encountered at the trench bottom that will not uniformly support the pipe, excavate the material to the depth directed by the Engineer and backfill to trench subgrade elevation with trench stabilization material.
  5. Water Control:
    - a. Promptly remove and dispose of water entering the trench as necessary to for a prepared trench bottom. Do not lay pipe in water. Dewater as necessary, as specified in Division 2 Section "Earthwork",.
    - b. Divert surface water from draining into trenches.
    - c. Remove water in a manner that limits soil erosion from the trench sides and bottom.
    - d. Provide continuous water control during trenching.
- C. Trenching Safety and Protection
1. Provide all shoring, bracing and tight sheeting required to prevent caving and protect workers at all times, meeting current Occupational Safety and Health Act Requirements, and to protect adjacent property and structures. The stability of construction excavations and associated worker safety, including slope geometry and shoring/bracing considerations, are the responsibility of the Contractor. Meet current OSHA federal or state regulations, whichever takes precedence. This may require design of temporary slopes and or shoring by a licensed professional engineer at the cost of the Contractor. The cost of this shall be included in the cost for trench excavation.

### 3.3 TRENCH FILLING AND BACKFILLING

- A. General
1. Backfill all trenches as specified immediately after grade, alignment, and pipe jointing has been inspected and approved by the Engineer. Conduct any pipe testing as specified before completing filling and backfilling. Correct all defects discovered by tests prior to completing backfilling.
- B. Trench Stabilization Material Placement, if required
1. Furnish imported trench stabilization material as specified.
  2. Place over the full width and depths of trench in maximum 6-inch lifts.
  3. Check grade and correct general irregularities in material for ease of placement of overlying bedding material.
- C. Pipe Bedding Placement
1. Furnish imported bedding material as specified.

2. Place over the full width and depths of trench in maximum 6-inch lift. Hand-grade and compact to provide a firm and unyielding subgrade.
  3. Check grade and correct irregularities in bedding material. Loosen top 1 inches to 2 inches of compacting bedding by rake to provide a cushion before laying pipe.
  4. Couplings/Joints: Carefully excavate into bedding at each joint to allow for proper assembly and inspection of joint and uniform bearing along the barrel of the pipe. Provide concrete bedding under large, buried features and assemblies.
- D. Backfill Placement in Pipe Zone
1. After the pipe bedding material is placed, place the pipe zone material.
  2. Restrain pipe as necessary to prevent movement under backfilling operations.
  3. Place material simultaneously in lifts on both sides of pipe, and, if applicable, between pipes installed in the same trench.
  4. The first lift shall be no more than 1/2-pipe diameter, but never more than 6 inches. Each successive lift shall be no more than 6 inches.
  5. Thoroughly tamp each lift on sides and under haunches by “walking in” and working material under haunches with a shovel compacted as specified and backfill the trench.
  6. After the full depth of the pipe zone material has been specified, compact the material by a minimum of three passes of a vibratory plate compactor. Do not use power-driven impact compactors, or bucket compacting techniques to compact the pipe zone material.
- E. Detectable Buried Warning Tape and Locating wire
1. Continuously install tape and wire along the centerline of all buried pipe on top of the pipe zone as shown on the plans.
- F. Backfill Placement Above Pipe Zone:
1. After the pipe zone material is placed, place select backfill material above pipe zone. Compact to 95% Relative Compaction in accordance with ASTM D1557.
  2. Adjust moisture content to meet the specified compaction.
  3. Do not allow the backfill material to free fall into the trench until at least 2 feet of material is placed in this zone.
  4. Backfill to grade allowing for surface finishes, gravel, pavement, topsoil, etc.
- G. Watering
1. Apply uncontaminated water, when required, at the locations and in the amounts required to compact the backfill material to the specified requirements. Maintain an adequate water supply during the work. Assure the equipment used for watering is of the capacity and design to provide uniform water application.
  2. Apply water during the work to control dust and to maintain all embankment and base courses, etc.

### 3.4 QUALITY CONTROL

- A. General:
1. Notify Engineer when trench excavations have reached required grade.
  2. Notify Engineer when trench bottom and alignment is ready for inspection.
  3. Notify Engineer when pipe is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
  4. Notify Engineer when soft or loose materials are encountered.

5. Notify Engineer when fill material appears to be deviating from Specifications.
  6. Geotechnical Testing Agency Qualifications: An independent testing agency qualified to conduct soil materials and rock-definition testing.
  7. Provide adequate survey control to avoid over-excavation and proper trench alignment.
- B. Source Testing:
1. As necessary to locate acceptable sources if imported material, minimum of one gradation test per imported material type, and additional index testing as required by Engineer to assure material meets the specifications.
  2. During production of imported material, test each granular material on a frequency of one gradation test per 1,000 cubic yards. Provide additional gradation testing to confirm material meets specifications, as required by Engineer.
- C. Testing: *Refer to the Geotechnical Engineering Report* (Appendix 1 of the Project Manual).

**END OF SECTION**

## SECTION 02232

### SITE CLEARING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Protecting existing trees and vegetation to remain.
  - 2. Removing trees and other vegetation.
  - 3. Clearing and grubbing.
  - 4. Topsoil stripping.
  - 5. Removing above-grade site improvements.
  - 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
  - 7. Disconnecting, capping or sealing, and removing site utilities.
- B. Related Sections include the following:
  - 1. Division 1 Section "Construction and Temporary Facilities" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
  - 2. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
  - 3. Division 2 Section "Seeding" for finish grading, including placing and preparing topsoil for lawns and planting.

##### 1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of weeds, roots, and other deleterious materials.

##### 1.4 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from the site.

##### 1.5 SUBMITTALS



- A. Photographs or video, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings according to Division 1 Section "Closeout Procedures."
  - 1. Identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

## 1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, site operations, and other adjacent occupied or used facilities during site-clearing operations.
  - 1. Do not close or obstruct streets, walks, operations areas (without consent of the Owner) or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
  - 2. Provide alternate routes around closed or obstructed traffic ways and operations areas if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Work on adjoining properties is not included in the scope of this project.
- C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Notify utility locator service for area where Project is located before site clearing.

## PART 2 - PRODUCTS

### 2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 2 Section "Earthwork."
  - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
  - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

### 3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
  - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
  - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
  - 1. Cover exposed roots with burlap and water regularly.
  - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
  - 3. Coat cut faces of roots more than 1-1/2 inches (38 mm) in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
  - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Engineer.
  - 1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
  - 2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.
- E. Transplant trees and vegetation indicated to be relocated to the location designated by the Engineer, in a manner approved by Engineer.
  - 1. Employ a qualified arborist or landscaping expert, licensed in jurisdiction where Project is located, to transplant trees and shrubs.
  - 2. Operation shall be completed in such manner as to protect the root wad of the tree or other vegetation.

### 3.3 UTILITIES

- A. Contractor shall arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing. Coordinate with Engineer and Owner.
  - 1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
  - 1. Arrange to shut off indicated utilities with utility companies and provide temporary as needed and coordinated with Owner to maintain site operations.

### 3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
  - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
  - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
  - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
  - 4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
  - 1. Place fill material in horizontal layers not exceeding 8-inch (200-mm) loose depth and compact each layer to a density equal to adjacent original ground.

### 3.5 TOPSOIL STRIPPING

- A. Remove vegetation before stripping topsoil.
- B. Strip topsoil to whatever depths that are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
  - 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water.
  - 1. Do not stockpile topsoil within drip line of remaining trees.
  - 2. Dispose of excess topsoil as specified for waste material disposal.
  - 3. Stockpile surplus topsoil and allow for resspreading deeper topsoil.

### 3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
  - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-faces vertically.

### 3.7 DEMOLITION

- A. Remove entire building as indicated.
- B. Do not begin removal until receipt of notification to proceed from Owner and Engineer.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.

- D. Do not begin removal until vegetation to be relocated has been removed and specified measures have been taken to protect vegetation to remain.
- E. Protect existing structures and other elements that are not to be removed.
- F. Provide bracing and shoring.
- G. Prevent movement or settlement of adjacent structures.
- H. Stop work immediately if adjacent structures appear to be in danger.
- I. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- J. If hazardous materials are discovered during removal operations, stop work and notify Engineer and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- K. Hazardous Materials: Comply with 29 CFR 1926 and state and local regulations.
- L. Perform demolition in a manner that maximizes salvage and recycling of materials.
- M. Dismantle existing construction and separate materials.
- N. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point onsite as coordinated with Owner.
- O. Existing Utilities:
  - 1. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
  - 2. Protect existing utilities to remain from damage.
  - 3. Do not disrupt public utilities without permit from authority having jurisdiction.
  - 4. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
  - 5. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
  - 6. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
  - 7. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
  - 8. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

### 3.8 DEBRIS AND WASTE DISPOSAL

- A. Collect debris, junk, and trash and arrange with Owner (and Owner's Contractor) for disposal by hauling material to offloading (dump) locations.

- B. Leave site in clean condition, ready for subsequent work.
- C. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them on Owner's property. Coordinate with Owner.
- D. Cleanup spillage and windblow debris from any public and private lands caused by Contractor's work.

**END OF SECTION**

## SECTION 02300

### EARTHWORK

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Reports* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Preparing subgrades for slabs-on-grade and lawns and grasses.
  - 2. Excavating and backfilling for buildings, structures and retaining walls.
  - 3. Subsurface drainage backfill for walls.
  - 4. Incidental excavation and backfill for utilities located under or adjacent to structures.
- B. Related Sections include the following:
  - 1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
  - 2. Division 2 Section "Site Clearing" site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
  - 3. Division 2 Section "Trenching" for pipe and utility trenching work, including excavation, trench foundation stabilization, and backfill.
  - 4. Division 3 Section "Structural Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
  - 5. Division 2 Section "Trenching" for installing underground electrical utilities and buried electrical structures.

##### 1.3 DEFINITIONS

- A. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- B. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Division 1 "Measurement and Payment" or Contract provisions for changes in the Work.
  - 2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

- C. Fill: Soil materials used to raise existing grades.
- D. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 1 cubic yard or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- F. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, or topsoil materials.
- G. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D1557 for each on-site and borrow soil material proposed for fill and backfill.
  - 3. When, in the opinion of the Engineer, the field soil conditions differ from those represented by the material test reports, new samples shall be taken by the Contractor and delivered to the testing agency for classification and laboratory compaction curve testing. All testing shall be based on the appropriate soil test results.
  - 4. Compaction equipment used for the project.
- B. Information Submittals:
  - 1. Geotechnical Testing Agency Qualifications: An independent testing agency approved by the Engineer qualified to conduct soil materials and rock-definition testing.

#### 1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
  - 1. Notify Engineer not less than two weeks in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Engineer's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## **PART 2 - PRODUCTS**

### **2.1 SOIL / ROCK MATERIALS**

- A. General:
  - 1. Refer to the *Geotechnical Engineering Report* (Appendix 1 of the Project Manual) for definitions and material information.
  - 2. Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
  - 3. Site soil is not suitable for reuse in as Structural Fill but is acceptable as General Fill.
  - 4. All fill behind walls and around structures and footings for this project must be placed and compacted as Structural Fill.
- B. General Fill: Material obtained from excavations that is free of cinders, ash, refuse, organic or frozen material, boulders, or other deleterious materials. Material to be used for bringing existing grades up to subgrade elevations.
- C. Pipe Bedding: Bedding material for utility trenches shall conform to ISPWC Section 305 – Pipe Bedding.
- D. Drain Rock: Drain rock shall conform to ISPWC specification for 3” drain rock, per ISPWC Section 801- Uncrushed Aggregates. For use behind retaining walls.
- E. Structural Fill: Used for structure and wall backfill material, under footings and foundations and under pads. Material shall conform to ISPWC specifications for Type II Crushed Aggregate, per ISPWC Section 802 - Crushed Aggregates. *See Geotechnical Engineering Report* (Appendix 1 of the Project Manual) for compaction requirements for Structural Fill based on use and location.
- F. Crushed Aggregate: Used as Structural Fill, gravel surfacing and below asphalt pavement. Material shall conform to ISPWC Section 802 – Crushed Aggregates. *See Geotechnical Engineering Report* (Appendix 1 of the Project Manual) for the type of crushed aggregate and required in place densities.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 2 Section "Site Clearing."
- C. Protect and maintain erosion and sedimentation controls, which are specified in Division 2 Section "Site Clearing," during earthwork operations, and applicable Special Provisions.



- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

### 3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. If required, install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

### 3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized regardless of the character of surface and subsurface conditions encountered.
  - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
- B. Classified Excavation: If rock is encountered within excavations, cease work in the area where rock is discovered until a time and materials change order for the extra work can be agreed upon by the Contractor, Owner, and Engineer. The work in the affected area will again proceed after a change order is processed, and no shutdown time or associated additional costs will be awarded other than those agreed upon in the change order.

### 3.5 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.5 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 0.5 inch. Do not disturb bottom of excavations intended as bearing surfaces.

### 3.6 SUBGRADE INSPECTION

- A. Notify Engineer when excavations have reached required subgrade.
- B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with Structural Fill as directed.
- C. Perform compaction testing as required by the *Geotechnical Engineering Reports*. If materials are not suitable for nuclear gauge testing, perform proof rolling operations.
- D. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
  - 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
  - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Engineer, and replace with compacted backfill or fill as directed.
- E. Authorized additional excavation and replacement material will be paid for according to Contract provisions.
- F. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

### 3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi (17.2 MPa), may be used when approved by Engineer.
  - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

### 3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
  - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

### 3.9 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
  - 1. Construction below finish grade including, where applicable, subdrainage, damp proofing, waterproofing, and perimeter insulation.
  - 2. Surveying locations of underground utilities for Record Documents.

3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

### 3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
1. Under topsoil and planted/stabilized areas, use General Fill.
  2. Under steps, ramps, building slabs, footings, foundations and pads, use Structural Fill.
  3. Under retaining walls, use Structural Fill.
  4. Adjacent to retaining walls, use Drain Rock.
  5. In utility trenches within 5 feet of any retaining wall or foundation, use Structural Fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

### 3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
  2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

### 3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. General: *See Geotechnical Engineering Report* (Appendix 1 of the Project Manual).
- B. Place backfill and fill soil materials in layers not more than 12 inches in loose depth for material compacted by heavy compaction equipment weighing no less than 5 tons. If a smaller or lighter compaction equipment is used, reduce the lift thickness to meet the compaction requirements.
- C. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- D. Where backfill is to extend higher on one side than on the other, as indicated on the Plans, structural floor beams or other means of restraint shall be installed before such backfill is placed. Should any deflection of the foundation wall result from the Contractor's failure to provide adequate bracing, the Contractor shall remove the backfill

or embankment to relieve the deflection, properly brace the wall, and replace the backfill at no additional cost to the Owner.

- E. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
  - 1. Under structures, building slabs and steps, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
  - 2. Under unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
- F. For placement and compaction of fill material behind retaining walls, see *Geotechnical Engineering Reports*.

### 3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.
  - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
  - 1. Unpaved Areas: Plus or minus 1 inch
- C. Grading inside Building and Structure Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.14 QUALITY CONTROL

- A. General:
  - 1. Notify Engineer when excavations have reached required grade.
  - 2. Notify Engineer when subgrade and layout is ready for inspection.
  - 3. Notify Engineer when ready for filling, and whenever filling operations are resumed after a period of inactivity.
  - 4. Notify Engineer when soft or loose materials are encountered.
  - 5. Notify Engineer when fill material appears to be deviating from Specifications.
  - 6. Geotechnical Testing Agency Qualifications: An independent testing agency qualified to conduct soil materials and rock-definition testing.
  - 7. Provide adequate survey control to avoid over-excavation and proper layout and alignment.
- B. Source Testing:
  - 1. As necessary to locate acceptable sources if imported material, minimum of one gradation test per imported material type, and additional gradation testing as required by Engineer to assure material meets the specifications.
  - 2. During production of imported material, test each granular material on a frequency of one gradation test per 1,000 cubic yards. Provide additional gradation testing to confirm material meets specifications, as required by Engineer.

- C. Testing: See *Geotechnical Engineering Report* (Appendix 1 of the Project Manual).

### 3.15 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

### 3.16 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and dispose of it on Owner's property. Coordinate with Owner.

**END OF SECTION**

## SECTION 02303

### SOIL STABILIZATION

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Seeding.
  - 2. Mulching
  - 3. Fertilizer.
  - 4. Matting.
- B. Related Sections include the following:
  - 1. Division 1 Section "Construction and Temporary Facilities" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, permits, and environmental protection measures during construction.
  - 2. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
  - 3. Division 2 Section "Topsoil" for topsoil material placement.

##### 1.3 DEFINITIONS

- A. Maintenance Period: Begin maintenance immediately after each area is planted and continue for a period of 8 weeks after planting under this section is completed.
- B. Satisfactory Stand: Grass or section of grass of 10,000 square feet or larger that has:
  - 1. No bare spots larger than 3 square feet.
  - 2. Not more than 10% of total area with bare spots larger than 1 square foot.
  - 3. Not more than 15% of total area with bare spots larger than 6 square inches.

##### 1.4 SUBMITTALS

- A. Samples, product information, and datasheets for all specified equipment and products herein and shown on the plans.
- B. Temporary Erosion and Sediment Control Plan (TESC) in accordance with the Standard Specifications.
  - 1. Seed Certifications
  - 2. Copies of delivery invoices or proof of quantities of products.
  - 3. Application rate for products to achieve a satisfactory stand.

## 1.5 DELIVERY, STORAGE, AND PROTECTION

- A. Seed: Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, and hard seed and maximum weed seed content, clearly marked for each container of seed.
- B. Hydroseeding Mulch: Mark package of wood fiber mulch to show air dry weight.

## 1.6 SEQUENCING AND SCHEDULING

- A. Retain all temporary erosion and sediment control features until such time that the soil is stabilized. Remove those that are no longer needed.
- B. Prepare topsoil as specified in Section 02709, Topsoil before starting Work of this section
- C. Complete soil preparation, seeding, fertilizing, mulching, and matting within 10 days after final grades have been reached.
- D. Notify Engineer at least 3 days in advance of:
  - 1. Materials delivery.
  - 2. Start of planting/seeding activity.
- E. Seeding: Perform under favorable weather conditions during seasons that are normal for such Work as determined by accepted local practice.

## 1.7 APPLICATION AREAS

- A. General: All disturbed areas not receiving surfaces.
- B. All stormwater ponds, ditches, slopes, and permanent soil stockpiles.

## 1.8 MAINTENANCE

- A. General:
  - 1. Perform during maintenance period to include:
    - a. Watering: Keep seeded surface moist.
    - b. Washouts: Repair by filling with topsoil, fertilizing, seeding, and mulching.
    - c. Mulch: Replace wherever and whenever washed or blown away.
    - d. Reseed unsatisfactory areas or portions thereof immediately at end of maintenance period if a satisfactory stand has not been produced.
    - e. Reseed during next planting season if scheduled end of maintenance period falls after normal growing season.
    - f. Reseed entire area if satisfactory stand does not develop by late spring of the following year.
- B. Maintenance Service Agreement: Provide for period of 1 year from Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 FERTILIZER**

- A. Commercial, uniform in composition, free-flowing, suitable for application with equipment designed for that purpose.
- B. Fertilizer shall have minimum percentages of plant food based on local standard practice to achieve satisfactory stand.

### **2.2 SEED**

- A. Fresh, clean new-crop seed that complies with tolerance for purity and germination established by Official Seed Analysts of North America.
- B. Seed mix shall be provided using locally acceptable practices.

### **2.3 MULCH**

- A. Wood Cellulose Fiber Mulch:
  - 1. Specially processed wood fiber containing no growth or germination inhibiting factors.
  - 2. Dyed suitable color to facilitate inspection of material placement.
  - 3. Manufactured such that after addition and agitation in slurry tanks with water, material fibers become uniformly suspended to form homogenous slurry.
  - 4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.
- B. Straw:
  - 1. Clean salt hay or threshed straw of oats, wheat, barley, or rye, free from seed of noxious weeds. Suitable for spreading with mulch blower equipment.
  - 2. Average Stalk Length: 6 inches.
  - 3. Seasoned before baling or loading.

### **2.4 TACKIFIER**

- A. Derived from natural organic plant sources containing no growth or germination-inhibiting materials.
- B. Capable of hydrating in water, and to readily blend with other slurry materials.

### **2.5 GEOSYNTHETICS**

- A. Erosion Control Matting:
  - 1. Sideslopes (steeper than 4H:1V):
    - a. Excelsior mat or straw blanket; staples as recommended by matting manufacturer.



- b. Manufacturer and Product: North America Green, Evansville, IN; S150 Blanket, or equal.
  - 2. Ditches (steeper than 2%):
    - a. Long lasting and suitable for ditch applications, staples as recommended by the matting manufacturer
    - b. The blanket shall be covered on the top with heavy-weight photodegradable polypropylene netting having ultraviolet additives to delay breakdown.
    - c. Manufacturer and Product: North American Green, Evansville, IN; P300, or equal.
- B. Filter Fabric (for Silt Fences): ISPWC specification for temporary silt fence geotextile, per ISPWC Section 2050 – Construction Geotextiles.

## **PART 3 - EXECUTION**

### **3.1 SOIL PREPARATION**

- A. Before beginning of any seeding and after surface has been graded, and lightly compacted to uniform grade, scarify soil surface to a minimum depth of 1 inch.

### **3.2 SEEDING**

- A. Prepare 1-inch-deep seed bed; obtain Engineer's acceptance prior to proceeding.
- B. Apply by seed on moist soil, but only after free surface water has drained away. Prevent drift and displacement of mixture into other areas.
- C. Application rate shall be determined based on type of seed, time of year, and locally acceptable practices.

### **3.3 MULCHING**

- A. Apply uniformly on seeded areas. Do not apply mulch on seeded areas that will be immediately covered with erosion control matting.
- B. Application: Sufficiently loose to permit penetration of sunlight and air circulation, and sufficiently dense to shade ground, reduce evaporation rate, and prevent or materially reduce erosion of underlying soil. Apply at locally acceptable rates.

### **3.4 EROSION CONTROL MATTING**

- A. Place on seeded area slopes greater than 4H:1V and along all ditches steeper than 2%; staple in place and overlap in accordance with manufacturer's instructions. Refer also to the Drawings for locations requiring matting.

### **3.5 TACKIFIER**

- A. Apply on all mulched areas; spray on after all mulch is in place; and apply at locally acceptable rates for materials, slopes, and conditions.

### 3.6 QUALITY CONTROL

- A. Install all erosion and sediment control features with good workmanship, locally acceptable standards, and in accordance with manufacturer's instructions.
- B. Upon completion of the maintenance period and written notification from the Contractor, Engineer within 15 days of receipt will determine if a satisfactory stand has been established.
- C. If a satisfactory stand has not been established, Engineer will make another determination upon written notice from Contractor following the next growing season.

**END OF SECTION**

## SECTION 02665

### PIPING, VALVES, AND APPURTENANCES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section include the following:
  - 1. Furnishing and installing pipes and fittings and associated appurtenances.
  - 2. Pipe Cleaning and Disinfection.
- B. Related Sections include the following:
  - 1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
  - 2. Division 2 Section "Site Clearing" for temporary erosion and sedimentation control measures, site stripping, grubbing, and removal of above- and below-grade improvements and utilities.
  - 3. Division 2 Section "Trenching" for pipe and utility trenching work, including excavation, trench foundation stabilization, and backfill.
  - 4. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

##### 1.3 SUBMITTALS

- A. Certifications of qualifications for pipe fitters / welders; installation and thermal fusion welding of HDPE pipe in accordance with Code of Federal Regulations (CFR) Title 49 and Part 192.285.
- B. Product information, shop drawings of pre-assembled/shop fabricated sections, and datasheets for all specified equipment and products.
- C. Testing Work Plan(s):
  - 1. Piping section(s) to be tested, proposed dates, method of isolation, method of conveying water to the source for testing, test pressure calculation(s), and steps.
  - 2. Testing Report(s):
    - a. Test logs, certificate of calibration of instruments used for testing, testing results and documentation.
- D. Product information datasheets for all specified equipment and products herein and shown on the Drawings.
- E. Test Reports: Certified test reports from a qualified testing agency for compliance with the specifications and pipe pressure testing reports.

## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Furnish all piping as specified in the Contract Documents and meeting the materials and testing requirements of this Section. Furnish all fittings of the same material and design as the specified piping. Furnish the pipe sizes and strength classifications shown in the Contract documents.
- B. Assure all pipe is clearly marked with type, class and/or thickness as applicable. Assure lettering is legible and permanent under normal handling and storage conditions.
- C. Furnish a manufacturer's certification for all pipe and fittings, certifying that the pipe and fittings meet the contract requirements.

### **2.2 PVC PIPE AND FITTINGS**

- A. All 4-inch through 12-inch diameter PVC pipe used for water lines shall be rated per AWWA, C900, DR18, Class 150. PVC pipe less than 4-inches in diameter shall be Schedule 80 with a pressure rating of 200 psi.
- B. Fittings to be manufactured from PVC material which needs or exceeds the requirements of ASTM D-1784, cell classification 12454B, Type 1, Grade 1.
- C. All solvent cements used to conform to ASTM D-2564. Welding rod used in the manufacture of the above fittings, shall conform to ASTM D-1784, cell class 12454B for PVC, and shall be of a material compatible with the corresponding pipe.
- D. Use PVC Schedule 80 pipe white in color for any storm drain(s).

### **2.3 POLYETHYLENE PIPE**

- A. Water pipe:
  - 1. Furnish HDPE pipe for all waterlines with a minimum pressure rating of 200 psi
  - 2. Assure all pipe is NSF approved.
  - 3. Pipe shall be blue in color.
  - 4. Pipe shall be ADS PolyFlex™ Potable water service tubing (CTS) meeting requirements of ASTM D3350, or equal.
  - 5. For tees use a quick joint tee for CTS pipe as manufactured by Ford Meter Box Company, or equal.
  - 6. For valves use a ball valve curbstop for CTS pipe as manufactured by Ford Meter Box Company, or equal.
  - 7. For adjoining pipe, use quick joint couplings for CTS pipe as manufactured by Ford Meter Box Company, or equal. Use stainless steel inserts/stiffeners for quick

joint couplings as manufactured by Ford Meter Box Company.

8. Assure pipe is manufactured with an ultraviolet (UV) stabilizer.
9. Furnish HDPE pipe with iron pipe size (IPS) outside diameters. Assure dimensions and workmanship meet ASTM D3035 for nominal diameters smaller than 4 inches (100 mm).

## 2.01 VALVES

### A. General:

1. Valves shall include operators, extension stem, operating nut and accessories to allow a complete operation for intended use.
2. Valve shall be suitable for intended service.
3. Valve shall be the same size as the adjoining pipe, unless otherwise specified or shown on the plans.
4. Valve ends to suit adjacent piping.
5. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated pressure.
6. Valve shall open by turning clockwise. Use factory mounted operator, actuator, where required, and accessories.

### B. Operators:

1. General:
  - a. Operator force shall be no more than 40 pounds under any operating condition, including initial breakaway.
  - b. Operator with self-locking device or equipped with self-locking device.
  - c. Position indicator on quarter-turn valves.
2. Buried Service:
  - a. Shall be 2-inch AWWA operating nut. Enclose moving parts of valve and operator in housing to prevent contact with the soil.
  - b. Buried valves shall have extension stems, bonnets, and valve boxes. Extension stem shall be provided to within 2 feet of the surface.
  - c. Valve boxes shall have traffic rated lids.

### C. Valve Boxes:

1. Waterline valve box tops shall be gray iron material for heavy duty traffic loading and dipped coated. Valve box bottoms shall be of the same material and manufacturer as the top boxes. The valve box covers shall also be of the same material and manufacturer with "WATER" lettering.

### D. Accessories:

1. T-Handled Operating Wrench:
  - a. Provide one t-handle operating wrench. Coordinate with Owner for length.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Excavation and Backfill – Excavate and backfill pipelines per Division 2 specifications.
- B. Responsibility for Materials:
  - 1. The Contractor is responsible for all material furnished. Replace all material found defective in manufacture or damaged in handling after delivery. This includes furnishing all material and labor required for the replacement of installed material discovered defective before final acceptance of the work or during the guarantee period.
  - 2. The Contractor is responsible for the safe storage of material intended for the work until it has been incorporated in the completed project.
- C. Handling of Pipe
  - 1. Deliver and distribute all pipe to the site. Load and unload pipe, fittings, and accessories by lifting with hoists or skidding to avoid shock or damage. Do not drop any materials. Do not roll or skid pipe handled on skidways against pipe already on the ground.
  - 2. In distributing the material at the site of the work, unload each piece opposite or near the place where it is to be laid in the trench. Keep the interior of all pipe and other accessories free from dirt and foreign matter at all times.
  - 3. Repair or replace all damaged pipe at Contractor's expense on the jobsite.
- D. Laying Pipe
  - 1. Lay and maintain all pipe to the specified lines and grades with fittings at the specified locations.
  - 2. Use tools and equipment, satisfactory to the Engineer, for the safe and convenient prosecution of the work. Carefully lower all pipe and fittings into the trench to prevent damage to the pipe materials and protective coatings and linings. Do not drop or dump any materials into the trench.
  - 3. Take every precaution to prevent foreign material from entering the pipe while it is being installed. At times when pipe laying is not in progress, close the open ends of the pipe using a plug or other means approved by the Engineer. Clean and remove all sand, gravel, concrete and cement grout that has entered the lines during construction.
  - 4. Place pipe bedding in the bottom of the trench meeting the Standard Specifications. Voids may be left in the bedding material to remove pipe slings to allow support along the full length of the pipe barrel.
  - 5. Cut pipe for inserting fittings in a neat and workmanlike manner without damaging the pipe or coating and leaving a smooth end at right angles to the pipe axis. Do not cut pipe using an oxyacetylene torch.
- E. Tolerances
  - 1. Install the pipe within ½ inch (13 mm) of the specified alignment and within ¼ inch (6 mm) of the specified grade.
- F. MECHANICAL COMPRESSION JOINTS FOR HDPE PIPE

1. Insert pipe stiffeners to provide support for the seal ring and gripping ring. Assure stiffener is long enough to prevent collapse of the pipe.
2. Compress the seals by tightening the threaded compression nuts or follower and bolt arrangements. Assure seals are pressure-tight.

### 3.2 VALVES

#### A. General:

1. Valve Installation and Orientation:  
Install valves to operate from fully open to fully closed without obstruction.  
Install valves in location for easy access for routine operation and maintenance. All valves in valve vaults shall be installed such that they can be operated from the surface using the t-handled operating wrench.

### 3.3 QUALITY CONTROL

#### A. Pipe Hydrostatic Testing (Water / Forcemain Pipes):

1. Conduct test on buried piping after trench has been completely backfilled. Testing may be done prior to placing final surface treatments such as concrete, asphalt, and road base, as approved by Engineer.
2. Contractor may if field conditions allow, pipe is secured, and as approved by Engineer partially backfill trenches and leave joints exposed for inspection to conduct the initial leak test. The final test is required to be conducted when the pipe is completely backfilled.
3. Supply temporary water and properly dispose of water as approved by Owner.
4. Preparation:
  - 1) Once the piping is laid and backfilled, install temporary thrust blocking or other restraints as necessary to prevent movement of the pipe and protect adjacent pipe and equipment. Make necessary taps and connections into piping prior to testing.
  - 2) Wait minimum 5 days after pouring thrust blocks before testing. If early high-concrete cement is used, wait a minimum 2 days before testing.
  - 3) Isolate new piping from existing piping.
  - 4) Remove all suitably isolated appurtenant instruments or devices that could be damaged during the testing.
  - 5) Interior of pipe shall be free of all foreign matter prior to conducting test.
5. Procedure:
  - 1) Test pressure for pressure contact water lines shall be 100 psi measured at the low point of the pipeline.
  - 2) Maximum filling velocity shall be 0.25 feet per second, calculated based on the fill inside cross-sectional area of the pipe. Expel air from pipe during filling. Expel through air release valve(s) or through corporation stop at high points and strategic points.
  - 3) Test procedure consists of two steps – (1) Stabilization Phase and (2) Test Phase. During the Stabilization Phase, apply and maintain the specified test

pressure with a hydraulic force pump. Valve-off piping when test pressure is reached. Add make-up water at hourly intervals for 2 hours to maintain test pressure. At the end of the 2 hours (after adding any make-up water to maintain test pressure), begin the Test Phase. Test Phase shall continue for another 2 hours. At the end of the Test Phase, determine pipe leakage. Leakage is defined as the quantity of water supplied into the pipe, or any valved section thereof, necessary bring the pressure back to the test pressure level. Log the water volume used.

- 4) If the test is not completed due to equipment failure, leakage, or other reasons, slowly depressurize the test section of pipe and allow the pipe to relax for a least 2 hours before retesting.
- 5) If test exceeds the allowable leakage rate, and/or if there are visible signs of leakage, repair defective pipe section or connection and repeat test.

b. Allowable Leakage:

- 1) The maximum allowable amount of make-up water at the conclusion of the Test Phase shall not exceed the amounts in the following table. The table is based on test pressures for SDR 11 pipe at 1.5 times the pressure class of the pipe. If pipe sizes or pipe classification differ, coordinate with Engineer for applicable allowable leakage values.

<b>Make-Up Water Allowance for Test Phase (U.S. Gallons per 100 feet of Pipe)</b>	
<b>Nominal Pipe Size (Inches)</b>	<b>2-Hour Test (Gallons)</b>
1	0.05
2	0.10
3	0.15
4	0.25
6	0.60

B. Pipe Low Pressure Air Testing (Gravity Drain Pipes – Storm and Contact Water [Leachate]):

1. Conduct test on buried piping after trench has been completely backfilled. Testing may be done prior to placing final surface treatments such as concrete, asphalt, and road base, as approved by Engineer.
2. Contractor, may if field conditions allow, pipe is secured, and as approved by Engineer partially backfill trenches and leave joints exposed for inspection to conduct the initial leak test. The final test is required to be conducted when the pipe is completely backfilled.
3. Preparation:
  - 1) Once the piping is laid and backfilled, install temporary thrust blocking or other restraints as necessary to prevent movement of the pipe and protect adjacent pipe and equipment. Make necessary taps and connections into piping prior to testing.
  - 2) Wait minimum 5 days after pouring thrust blocks before testing. If early high-concrete cement is used, wait a minimum 2 days before testing.
  - 3) Isolate new piping from existing piping.
  - 4) Remove all suitably isolated appurtenant instruments or devices that could be damaged during the testing.



- 5) Interior of pipe shall be free of all foreign matter prior to conducting test.
4. Procedure:
  - 1) Plug all pipe outlets with suitable plugs rated for the air testing pressure. Brace plugs securely. Segments of pipe to be tested can be isolated using the nearest valve or by temporarily installing plugs or blind flanges. If valves are not suitable for testing, use temporary plugs or blind flanges.
  - 2) Add air slowly until an internal air pressure of 4 psig is reached. Check all exposed pipes and plugs and fittings for leakage by coating with a soap solution (not permitted under freezing temperatures). If any leaks are found, bleed off air and make repairs, and then restart the test.
  - 3) Test procedure consists of two steps – (1) Stabilization Phase and (2) Test Phase. During the Stabilization, apply and maintain the specified test air pressure delivered by the air compressor. Valve-off piping system when test pressure is reached. Add make-up air at hourly intervals for 2 hours to maintain test pressure. At the end of the 2-hour Stabilization Phase (after adding any make-up air to maintain test pressure), begin the Test Phase. Test Phase shall continue for another 2 hours. At the end of the Test Phase, to pass the test there should be no measurable change in air pressure.
  - 4) If the test is not completed due to equipment failure, leakage, or other reasons, slowly depressurize the test section of pipe and allow the pipe to relax for a least 2 hours before retesting.
  - 5) If test fails, repair the defective pipe section or connection and repeat test.
2. Valves Testing and Inspection:
  - 1) Valve may be either tested while testing pipes, or as a separate step.
  - 2) Test that valves open and close smoothly under operating pressure conditions.
  - 3) Count and record the number of turns to fully open and close valves; account for any discrepancies in manufacturer's data.
  - 4) Set, verify, and record set pressure for relief and regulating valves.

### 3.4 CLEANING AND DISINFECTION

- A. Verify that water piping systems and water wells have been cleaned, inspected, and pressure tested.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting, and balancing, demonstration procedures, including related systems.
- C. Disinfection:
  1. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.
  2. Provide and attach equipment required to perform the work.
  3. Inject treatment disinfectant into piping system.
  4. Maintain disinfectant in system for 24 hours.
  5. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
  6. Replace permanent system devices removed for disinfection.
  7. Test samples in accordance with AWWA C651.

### END OF SECTION

## SECTION 02709

### TOPSOIL

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Placing topsoil at the locations shown on the Drawings.
- B. Related Sections include the following:
  - 1. Division 1 Section "Construction and Temporary Facilities" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities, and environmental protection measures during site operations.
  - 2. Division 2 Section "Site Clearing" for clearing materials and harvesting topsoil for reuse.
  - 3. Division 2 Section "Earthwork" for soil materials, excavating, backfilling, and site grading.
  - 4. Division 2 Section "Soil Stabilization" for permanently stabilizing the topsoil following placement.

##### 1.3 SUBMITTALS

- A. Material testing for any import topsoil material.
- B. Copies of delivery tickets for any import material.

#### PART 2 - PRODUCTS

##### 2.1 MATERIALS

- A. Topsoil shall consist of a natural friable surface soil consisting of loam, sandy loam, silty loam, silty clay loam, or clay loam, without admixtures of undesirable subsoil, refuse, or foreign materials. It shall be reasonably free from roots, hard clay, coarse gravel, stones larger than one inch in any dimension, noxious weeds, tall grass, brush, sticks, stubble or other material which would be detrimental to the proper development

of vegetative growth. Topsoil shall be obtained from naturally well drained sites where topsoil occurs at least 4-inches deep. Topsoil shall not be obtained from bogs, marshes, or wetlands.

## **PART 3 – EXECUTION**

### **2.2 GENERAL**

- A. All areas that are disturbed during construction which are not covered with surfacing shall be graded to a neat, uniform grade line and appearance and covered with a neat uniform, 6-inch minimum thickness of topsoil and seeded or hydroseeded, unless otherwise indicated in the Contract Documents.
- B. The topsoil shall be evenly spread on the designated areas to a depth, which, after settlement and compaction, shall be six inches, or as indicated in the Contract Documents. Spreading shall not be done when the ground or topsoil is frozen, excessively wet, or otherwise in a condition detrimental to the work. Roadway surfaces shall be kept clean during hauling and spreading operations.
- C. After spreading has been completed, large clods, stones larger than one inch in any dimension, roots stumps, and other litter shall be raked up and removed.
- D. The final grading of the topsoil prior to seeding or hydroseeding shall be to a tolerance that will not permit ponding of water in excess of one inch in depth.
- E. Topsoil Finish Grading:
  - 1. Provide labor personnel experienced with landscaping work that involves fine grading of topsoil for soil stabilization.
  - 2. Remove and dispose of all excess materials resulting from the finish grading of the topsoil.
  - 3. Prepare for seeding. Refer to Division 2 Section “Soil Stabilization.”

**END OF SECTION**

**SECTION 02760**  
**ASPHALT PAVING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

**1.2 SUMMARY**

- A. This Section includes the following:
  - 1. Asphalt Paving.
  - 2. Pavement Markings.
- B. Related Sections include the following:
  - 1. Division 1 Section "Temporary Facilities and Controls" for temporary controls, utilities, and support facilities.
  - 2. Division 2 Section "Site Clearing" site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
  - 3. Division 2 Section "Trenching" for pipe and utility trenching work, including excavation, trench foundation stabilization, and backfill.
  - 4. Division 2 Section "Earthwork" for site excavation, backfill, and subgrade preparation.

**1.3 DEFINITIONS**

- A. Combined Aggregate: All mineral constituents of asphalt concrete mix, including mineral filler and separately sized aggregates.
- B. Standard Specifications: ISWPC, current version.
- C. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

**1.4 SUBMITTALS**

- A. Asphalt Concrete Mix Formula:
  - 1. Submit minimum of 15 calendar days prior to start of production.
  - 2. Submittal to include the following information:
    - a. Gradation and portion for each aggregate constituent used in mixture to produce a single gradation of aggregate within specified limits.
    - b. Bulk specific gravity for each aggregate constituent.
    - c. Measured maximum specific gravity of mix at optimum asphalt content determined in accordance with the Standard Specifications.

- d. Properties as stated in the Standard Specifications for at least four different asphalt contents other than optimum, two below optimum, and two above optimum.
    - e. Percent of asphalt lost due to absorption by aggregate.
    - f. Index of Retained Strength (TSR) at optimum asphalt content as determined by AASHTO T283.
    - g. Percentage of asphalt cement, to the nearest 0.1% to be added to the mixture.
    - h. Optimum mixing temperature.
    - i. Optimum compaction temperature.
    - j. Temperature-viscosity curve of asphalt cement to be used.
    - k. Brand name of any additives to be used and the percentage of each to be added to the mixture.
  - 3. Test reports for asphalt cement: Submit minimum 10 days prior to start production and show appropriate test methods(s) for each material and the test results.
  - 4. Statement of qualifications for independent testing laboratory / consultant.
  - 5. All testing results for mix design, asphalt concrete core, gradation and asphalt content of uncompacted mix, field density, and quality control.
- B. Pavement markings.
- 1. Product data.
  - 2. Description of proposed methods for removal of drips, overspray, improper markings, and paint tracked by traffic.
  - 3. Manufacturer's certification for products specified herein.
  - 4. Equipment list, including descriptive data.
  - 5. Manufacturer's instruction for marking product application.

## 1.5 QUALITY CONTROL

- A. Qualifications:
- 1. Independent Testing Laboratory: In accordance with ASTM E329.
  - 2. Asphalt concrete mix formula shall be prepared by approved certified independent laboratory under the supervision of a certified asphalt technician.
  - 3. Markings applicator with reputable experience as approved by Engineer.
- B. Compaction Control Strip:
- 1. General:
    - a. Construct to approximately 1,000 square feet in area and at location that will become a portion of completed paved area.
    - b. Thickness: Typical of thickness to be paved on Project.
  - 2. Rollers Used for Compaction: As specified in the Standard Specifications.
  - 3. Compaction:
    - a. Compact bituminous mat, using a standard rolling pattern that covers entire control strip. Field density testing shall be conducted by the independent testing laboratory.
    - b. Continue rolling until no further compaction can be obtained as determined by field density testing.
    - c. Temperature and condition of bituminous mat shall be considered workable when further compaction can no longer be obtained.
  - 4. Target Density Determination:
    - a. Select test point near center of normal roller pass, but no closer than 600 millimeters (2 feet) from edge of mat and 15 meters (50 feet) from either end of

- control strip. Mat thickness at this point shall be at least depth of finished pavement.
  - b. Point at which no further densification can be obtained.
- 5. Establish new target density if change is made in mix design, nominal depth of mat being placed, aggregate source, or material properties

## 1.6 ENVIRONMENTAL REQUIREMENTS

- A. Temperature: Do not apply asphalt materials or place asphalt mixes when ground temperature is lower than 10 degrees C (50 degrees F) or air temperature is lower than 4 degrees C (40 degrees F). Measure ground and air temperature in shaded areas away from heat sources or wet surfaces.
- B. Moisture: Do not apply asphalt materials or place asphalt mixes when application surface is wet.
- C. Conform for requirements of the pavement markings product manufacturer.

## PART 2 - PRODUCTS

### 2.1 ASPHALT MATERIALS

- A. Mix design shall be Class 3 asphalt concrete and in conformance with Section 810 of the Standard Specifications.
- B. Asphalt Binder as specified in Section 805 of the Standard Specifications.
- C. Tack Coat: Emulsified asphalt, as specified in 805 of the Standard Specifications.
- D. Sand (Blotter Material): Clean, dry, with 100 percent passing No. 4 sieve, and a maximum of 10 percent passing No. 200 sieve.

### 2.2 HOT MIX ASPHALT

- A. General:
  - 1. Hot Mix Asphalt (HMA): HMA shall be composed of asphalt binder and mineral materials as may be required, mixed in the proportions specified to provide a homogenous, stable and workable mixture.
  - 2. Mix formula shall not be modified except with written approval of Engineer or Owner.
  - 3. Source Changes:
    - a. Should material source(s) change, establish new asphalt concrete mix formula before new material(s) is used.
    - b. Perform check tests of properties of plant-mix bituminous materials on first day of production and as requested by Engineer or Owner to confirm properties are following design. Adjust gradation or asphalt content as necessary to meet design criteria.
- B. Aggregate: Type 1 as specified in Section 802 of the Standard Specifications.

## **PART 3 - EXECUTION**

### **3.1 TRAFFIC CONTROL**

- A. In accordance with Section 1 “Construction and Temporary Facilities”.
- B. Keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.

### **3.2 LINE AND GRADE**

- A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.
- B. Shoulders: Construct to line, grade, and cross-section shown.

### **3.3 APPLICATION EQUIPMENT**

- A. In accordance with the Standard Specifications.

### **3.4 PREPARATION**

- A. Asphalt:
  - 1. Prepare subgrade as specified in Section 2 “Earthwork”.
  - 2. Follow requirements of the Standard Specifications for new construction of untreated roadways.
  - 3. General: Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.
- B. Pavement Markings:
  - 1. Cleaning:
    - a. Thoroughly clean surfaces to be marked before application of pavement marking material.
    - b. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water or a combination of these methods.
    - c. Completely remove rubber deposits, surface laitance, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion.
    - d. Scrub areas of old pavement affected with oil or grease with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application.
    - e. Surfaces shall be completely free of dirt and ice, and dry of water at the time of application of materials specified herein.
    - f. Oil-Soaked Areas: After cleaning, seal with cut shellac to prevent bleeding through the new paint.
    - g. Reclean surfaces when the Work has been stopped due to rain.
  - 2. Pretreatment for Early Painting: Where painting is required prior to 30 days after paving rigid pavements, pretreat with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride.

3. New Concrete Pavement/Slabs:
  - a. Allow a minimum cure time of 30 days before cleaning and marking.
  - b. Clean by either sandblasting or water blasting to the following results:
  - c. No visible evidence of curing compound on peaks of textured concrete surface.
  - d. No heavy puddled deposits of curing compound in valleys of textured concrete surface.
  - e. Remaining curing compound is intact, with loose and flaking material completely removed.
  - f. Peaks of textured pavement surface are rounded in profile and free of sharp edges and irregularities.
  - g. Allow a minimum drying time of 24 hours after water blasting before applying thermoplastic markings.
4. New Asphalt Pavement: Allow a minimum pavement cure time of 30 days before applying paint.

### 3.5 PAVEMENT APPLICATION

- A. General: Place HMA on approved, prepared base in conformance with the Standard Specifications.
- B. Tack Coat:
  1. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
  2. Do not apply more tack coat than necessary for the day's paving operation.
  3. Touch up missed or lightly coated surfaces and remove excess material.
  4. Application Rate: Minimum 0.25 liter to maximum 0.70 liter of asphalt (residual if diluted emulsified asphalt) per square meter (0.05 to
  5. 0.15 gallon per square yard) of surface area.
- C. Pavement Mix:
  1. Prior to Paving:
    - a. Sweep primed surface free of dirt, dust, or other foreign matter.
    - b. Patch holes in primed surface with asphalt concrete pavement mix.
    - c. Blot excess prime material with sand.
  2. Place asphalt concrete pavement mix in two equal lifts of 1.5 inches (compacted thickness).
  3. Total Compacted Thickness: 3 inches.
  4. Apply such that meet lines are straight and edges are vertical.
  5. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
  6. Joints:
    - a. Offset edge of each layer a minimum of 6 inches so joints are not directly over those in underlying layer.
    - b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
    - c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.
  7. Succeeding Lifts: Apply tack coat to pavement surface between each lift.
  8. After placement of pavement, seal meet line by painting a minimum of 6 inches on each side of joint with cut-back or emulsified asphalt. Cover immediately with sand.



- D.     Compaction: Uniformly compact each course to target density arrived at in compaction control strip.
- E.     Surface Smoothness Tolerances: As specified in Section 810 of the Standard Specifications.

### 3.6     ASPHALT PATCHING

- A.     Preparation:
  - 1.     Remove damaged, broken, or unsound asphalt concrete adjacent to patches. Trim to straight lines exposing smooth, sound, vertical edges.
  - 2.     Prepare patch subgrade as specified in Section 2 “Earthwork”.
- B.     Application:
  - 1.     Patch Thickness: 3 inches or thickness of adjacent asphalt concrete, whichever is greater.
  - 2.     Place asphalt concrete mix across full width of patch in layers of equal thickness.
  - 3.     Spread and grade asphalt concrete with hand tools or mechanical spreader, depending on size of area to be patched.
- C.     Compaction:
  - 1.     Roll patches with power rollers capable of providing compression of 200 to 300 pounds per linear inch. Use hand tampers where rolling is impractical.
  - 2.     Begin rolling top course at edges of patches, lapping adjacent asphalt surface at least 1/2 the roller width. Progress toward center of patch overlapping each preceding track by at least 1/2 width of roller.
  - 3.     Make sufficient passes over entire area to remove roller marks and to produce desired finished surface.
- D.     Tolerances:
  - 1.     Finished surface shall be flush with and match grade, slope, and crown of adjacent surface.
  - 2.     Tolerance: Surface smoothness shall not deviate more than plus 1/4 inch or minus 0 inches when straightedge is laid across patched area between edges of new pavement and surface of old surfacing.

### 3.7     PAVEMENT MARKING APPLICATION

- A.     General:
  - 1.     Apply materials in conformance with Standard Specifications, Section 1104.
  - 2.     Apply only when surface is dry.
  - 3.     Do not apply when conditions are windy to the point of causing overspray or fuzzy line edges.
  - 4.     Provide guidelines and templates to control paint application.
  - 5.     Take special precautions in marking numbers, letters, and symbols.
  - 6.     Sharply outline edges of markings and apply without running or spattering.
- B.     Drying:
  - 1.     Provide maximum drying time to prevent undue pickup, displacement, or discoloration by traffic.
  - 2.     If drying is abnormally slow, discontinue painting operations until cause is determined and corrected.

- C. Protection:
  - 1. Protect markings from traffic until paint is thoroughly dry.
  - 2. Protect surfaces from disfiguration by paint splatters, splashes, spills, or drips.
- D. Cleanup: Remove paint splatters, splashes, spills, or drips from the application and staging areas, including areas outside the immediate work areas where spills occurred.
- E. Cool completed markings to ambient outside temperature before allowing vehicular traffic and in conformance with the Standard Specifications and manufacturer's instructions.

### 3.8 QUALITY CONTROL

- A. General: *Refer to the Geotechnical Engineering Report* (Appendix 1 of the Project Manual).
- B. Asphalt test cores or sawed samples in accordance with AASHTO T230 and AASHTO T166 will only be required in suspect areas, if requested by the Engineer or Owner. Nuclear density gauge testing shall be done for field testing in accordance with ASTM D2950 on a frequency of one per 500 tons or once every 4 hours, whichever is greater.

**END OF SECTION**

## SECTION 02821

### CHAIN LINK FENCING AND GATES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Reports* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Chain Link Fences: Industrial
  - 2. Gates: Swinging or Rolling

##### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show locations, components, materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.

#### PART 2 - PRODUCTS

##### 2.1 CHAIN LINK FENCE FABRIC

- A. General: Height indicated on Drawings. Comply with ASTM A 392, CLFMI CLF 2445, and requirements indicated below:
  - 1. Steel Wire Fabric: Metallic coated 9-gauge wire with a diameter of 0.148 inch (3.76 mm), galvanized after weaving (GAW) or galvanized before weaving (GBW).
    - a. Mesh Size: 2 inches (50 mm).
    - b. Metallic (Zinc) Coating: ASTM A 392, Type II.
  - 2. Selvage: Twisted top and knuckled bottom.

##### 2.2 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
  - 1. Group: IC, round steel pipe, yield strength 50,000 psi (345 MPa)
  - 2. Coating for Steel Framing:
    - a. Metallic coating.

##### 2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at bottom of fence fabric.

- B. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817 and ASTM A 824.
  - 1. Metallic Coating: Type III, Zn-5-Al-MM alloy.

## 2.4 GATES

### A. General

- 1. Frame Corner Construction:
  - a. Welded and 5/16-inch diameter, adjustable truss rods for panels 5 feet (1.52 m) wide.
- 2. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame 14 inches (300 mm) as required to attach barbed wire assemblies.
- 3. Hardware: Latches permitting operation from both sides of gate and hinges. Fabricate latches with integral eye openings for padlocking, padlock accessible from both sides of gate.
- 4. Gate stops: Post and hardware to retain gate in open position.

### B. Rolling (Cantilever) Gates

- 1. General: Comply with ASTM F 900.
  - a. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
- 2. Track Rollers: Malleable iron or heavy pressed steel with provision for grease lubrication. Gates more than 8 feet in height shall have three tracks.
- 3. Support Posts: Spaced on maximum 7-foot centers.
- 4. Frames: ASTM F1184, Type I.
- 5. Gate Accessories: ASTM F1184.

### C. Swing Gates

- 1. General: Comply with ASTM F 900 for swing gate types.
  - a. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1083 and ASTM F 1043 for materials and protective coatings.
- 2. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
  - a. Gate Fabric Height: 2 inches (50 mm) less than adjacent fence height.
  - b. Leaf Width: As indicated.
  - c. Frame Members: Tubular Steel: 1.66 inches (42 mm) round, full weight

## 2.5 FITTINGS

- A. General: Comply with ASTM F 626.

### B. Finish:

- 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g /sq. m) zinc.
- 2. Aluminum: Mill finish.

## 2.6 BARBED WIRE

- A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121; 12.5 gauge 4-point round barbs spaced not more than 5 inches (127 mm) o.c.

## 2.7 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
  - 1. Material above Finished Grade: Copper.
  - 2. Material on or below Finished Grade: Copper.
  - 3. Bonding Jumpers: Braided copper tape, 1 inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.
- B. Connectors and Grounding Rods: Comply with UL 467.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install chain link fencing to comply with ASTM F 567 and more stringent requirements specified.
- B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.
- C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
  - 1. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
- D. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment.
- E. Line Posts: Space line posts uniformly at 10 feet (3 m) o.c.
- F. Post Bracing and Intermediate Rails: Install according to ASTM F 567. Install braces at end and gate posts and at both sides of corner and pull posts.
- G. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing.
- H. Top Rail: Install according to ASTM F 567.
- I. Chain Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated.
- J. Tie Wires: Attach wire per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- L. Barbed Wire: Uniformly spaced, angled toward security side of fence. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

### 3.2 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric matching the adjoining fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.
- B. Any reused gates on the project shall follow these same general instructions.

### 3.3 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m).
- B. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
  - 1. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location.
- C. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
  - 1. Connections: Make connections so possibility of galvanic action or electrolysis is minimized.

**END OF SECTION**

# **DIVISION 3**

## **CONCRETE**

**SECTION 03100**  
**CONCRETE FORMWORK**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes requirements for concrete formwork, bracing, shoring, supports, and falsework, in accordance with the Contract Documents.
- B. Related Requirements:
  - 1. Section 03300 – “Cast in Place Concrete”.
  - 2. Section 03200 – “Reinforcement Steel”.

1.3 ACTION SUBMITTALS

- A. The Contractor shall, in accordance with the requirements in Section 1 “Submittals”, submit detailed Drawings of the formwork proposed to be used including means of protecting existing construction which supports formwork, and typical soil conditions.
  - 1. The calculations and drawings shall be performed, sealed, and signed by a licensed professional civil engineer registered in the State of Montana.
- B. The Contractor shall, in accordance with the requirements in Section 1 “Submittals”, submit the following.
  - 1. Form ties and all related accessories, including taper tie plugs, if taper ties are used.
  - 2. Form gaskets.
  - 3. Form releasing agent.
  - 4. List of form materials and locations for use.

1.4 QUALITY ASSURANCE

- A. Tolerances: The variation from established grade or lines shall not exceed 1/4-inch in 10 feet and there shall be no offsets or visible waviness in the finished surface. All other tolerances shall be within the tolerances of ACI 117.



## **PART 2 - PRODUCTS**

### **2.1 GENERAL**

- A. Except as otherwise expressly accepted by the Engineer, all lumber brought on the job site for use as forms, shoring, or bracing shall be in good condition without cracks, etc. All forms shall be smooth surface forms and shall be of the following materials:
  - 1. Steel or plywood panel.
- B. Form materials which may remain or leave residues on or in the concrete shall be classified as acceptable for potable water use by the Environmental Protection Agency within 30 days of application or use.

### **2.2 FORM AND FALSEWORK MATERIALS**

- A. Materials for concrete forms, formwork, and falsework shall conform to the following requirements:
  - 1. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
  - 2. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
  - 3. Form materials shall be metal, wood, plywood, or other approved material that will not adversely affect the concrete and will facilitate placement of concrete to the shape, form, line, and grade shown. Metal forms shall be an approved type that will accomplish such results. Wood forms for surfaces to be painted shall be Medium Density Overlaid plywood, MDO Ext. Grade.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. Forms to confine the concrete and shape it to the required lines shall be used wherever necessary. The Contractor shall assume full responsibility for the adequate design of all forms, and any forms which are unsafe or inadequate in any respect shall promptly be removed from the Work and replaced at no increased cost to the Owner. Provide worker protection from protruding reinforcement bars in accordance with applicable safety codes. A sufficient number of forms of each kind shall be provided to permit the required rate of progress to be maintained. The design and inspection of concrete forms, falsework, and shoring shall comply with applicable local, state and Federal regulations. Plumb and string lines shall be installed before concrete placement and shall be maintained during placement. Such lines shall be used by Contractor's personnel and by the Engineer and shall be in sufficient number and properly installed. During concrete placement, continually monitor plumb and string line form positions and immediately correct deficiencies.
- B. Concrete forms shall conform to the shape, lines, and dimensions of members as called for on the Drawings, and shall be substantial, free from surface defects, and sufficiently tight to prevent leakage. Forms shall be properly braced or tied together to maintain their position and

shape under a load of freshly placed concrete. If adequate foundation for shores cannot be secured, trussed supports shall be provided.

### 3.2 FORM DESIGN

- A. All forms shall be true in every respect to the required shape and size, shall conform to the established alignment and grade, and shall be of sufficient strength and rigidity to maintain their position and shape under the loads and operations incident to placing and vibrating the concrete. Suitable and effective means shall be provided on all forms for holding adjacent edges and ends of panels and sections tightly together and in accurate alignment so as to prevent the formation of ridges, fins, offsets, or similar surface defects in the finished concrete.

### 3.3 CONSTRUCTION

- A. Vertical Surfaces: All vertical surfaces of concrete members shall be formed, except where placement of the concrete against the ground is shown. Not less than 1 inch of concrete shall be added to the thickness of the concrete member as shown where concrete is permitted to be placed against trimmed ground in lieu of forms. Such permission will be granted only for members of comparatively limited height and where the character of the ground is such that it can be trimmed to the required lines and will stand securely without caving or sloughing until the concrete has been placed.
- B. Construction Joints: Concrete construction joints will not be permitted at locations other than those shown or specified, except as may be acceptable to the Engineer. When a second lift is placed on hardened concrete, special precautions shall be taken in the way of the number, location, and tightening of ties at the top of the old lift and bottom of the new to prevent any unsatisfactory effect whatsoever on the concrete. Pipe stubs and anchor bolts shall be set in the forms where required.
- C. Form Ties:
  - 1. Embedded Ties: Holes left by the removal of form tie cones shall be reamed with suitable toothed reamers so as to leave the surface of the holes clean and rough before being filled with mortar as specified for "Finish of Concrete Surfaces" in Section 03300 - Cast-in-Place Concrete. Wire ties for holding forms will not be permitted. No form-tying device or part thereof, other than metal, shall be left embedded in the concrete. Ties shall not be removed in such manner as to leave a hole extending through the interior of the concrete members. The use of snap-ties which cause spalling of the concrete upon form stripping or tie removal will not be permitted. If steel panel forms are used, rubber grommets shall be provided where the ties pass through the form in order to prevent loss of cement paste. Where metal rods extending through the concrete are used to support or to strengthen forms, the rods shall remain embedded and shall terminate not less than 2 inches back from the formed face or faces of the concrete.
  - 2. Removable Ties: Where taper ties are approved for use, the larger end of the taper tie shall be on the wet side of walls in water retaining structures. After the taper tie is removed, the hole shall be thoroughly cleaned and roughened for bond. A precast neoprene or polyurethane tapered plug shall be located at the wall centerline. The hole shall be completely filled with nonshrink grout for water bearing and below-grade walls. The hole shall be completely filled with nonshrink or regular cement grout for above-grade walls which are dry on both sides. Exposed faces of walls shall have the outer 2

inches of the exposed face filled with a cement grout which shall match the color and texture of the surrounding wall surface.

#### 3.4 REUSE OF FORMS

- A. Forms may be reused only if in good condition and only if acceptable to the Engineer. Light sanding between uses will be required wherever necessary to obtain uniform surface texture on all exposed concrete surfaces. Exposed concrete surfaces are defined as surfaces which are permanently exposed to view. In the case of forms for the inside wall surfaces of hydraulic/water retaining structures, unused tie rod holes in forms shall be covered with metal caps or shall be filled by other methods acceptable to the Engineer.

#### 3.5 REMOVAL OF FORMS

- A. Careful procedures for the removal of forms shall be strictly followed, and this Work shall be done with care so as to avoid injury to the concrete. No heavy loading on green concrete will be permitted. Forms for all vertical walls shall remain in place at least 2 days after the concrete has been placed. Forms for all parts of the Work not specifically mentioned herein shall remain in place for periods of time as determined by the Engineer and ACI 347.

#### 3.6 MAINTENANCE OF FORMS

- A. Forms shall be maintained at all times in good condition, particularly as to size, shape, strength, rigidity, tightness, and smoothness of surface. Forms, when in place, shall conform to the established alignment and grades. Before concrete is placed, the forms shall be thoroughly cleaned. The form surfaces shall be treated with a nonstaining mineral oil or other lubricant acceptable to the Engineer. Any excess lubricant shall be satisfactorily removed before placing the concrete. Where field oiling of forms is required, the Contractor shall perform the oiling at least 2 weeks in advance of their use. Care shall be exercised to keep oil off the surfaces of steel reinforcement and other metal items to be embedded in concrete.

**END OF SECTION**

## **SECTION 03200**

### **REINFORCEMENT STEEL**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. ACI Publications as listed throughout. The Contractor must have a current copy of ACI SP-15 "Field Reference Manual" for concrete construction on site.

##### **1.2 SUMMARY**

- A. This Section specifies cast-in place concrete reinforcement and accessories.
- B. Related Sections include the following:
  - 1. Section 03300 – “Cast in Place Concrete”.
  - 2. Section 03100 – “Concrete Formwork”.

##### **1.3 SUBMITTALS**

- A. Steel Reinforcement Placing Drawings: Details of fabrication, bending, and field placement, prepared according to ACI 315, "Details and Detailing of Concrete Reinforcement." Include material grade, sizes, quantities, spacing, splice locations and laps, bending diagrams, arrangement, and supports of concrete reinforcement.
  - 1. Include bar placement diagrams which clearly indicate the dimensions and locations of each bar splice.
- B. Material Certificates and /or Test Reports: Signed by manufacturers or qualified testing agency certifying that steel reinforcement and reinforcement accessories comply with the Project requirements, including AIS certifications.

##### **1.4 QUALITY ASSURANCE**

- A. Concrete reinforcement placement shall be specially inspected per the International Building Code 2018 edition table 1705.3.
- B. Preinstallation Coordination: Conduct meeting to comply with requirements in Division 01 Section "Project Coordination."
  - 1. Before concrete work begins, review subgrade approval, placement operations, inspections, tolerances, splicing requirements, and construction joints.
  - 2. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
    - a. Contractor's superintendent.
    - b. Independent testing agency.
    - c. Ready-mix concrete manufacturer.

- d. Concrete subcontractor.
- e. Owner's Design Representative (Engineer).

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle steel reinforcement to keep clean (completely free of mud and oils) and prevent bending.

## PART 2 - PRODUCTS

### 2.1 REINFORCEMENT STEEL

- A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:
  - 1. Bar reinforcement; shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement or as otherwise indicated.
- B. Accessories:
  - 1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice.
  - 2. Concrete blocks (dobies), used to support and position reinforcement steel, shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.
    - a. The use of concrete blocks (dobies) is prohibited in elevated concrete slabs.

### 2.2 EPOXY GROUT

- A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03315 – “Grout”.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated and placed in accordance with the requirements of the Building Code and the supplementary requirements indicated herein.

### 3.2 FABRICATION

- A. General:
  - 1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315, ACI 318, and CRSI's "Manual of Standard Practice" except as modified by the Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2 inch for No. 3 bars, 2 inch for No. 4 bars, and 2-1/2 inch for No. 5 bars. Bends for other bars shall be

made around a pin having a diameter not less than six times the bar diameter, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

2. Fabricate reinforcement bars for structures in accordance with bending diagrams, placing lists, and placing drawings. Said drawings, diagrams, and lists shall be submitted in accordance with Section 01300 - Submittals.

- B. Fabricating Tolerances: Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared Length:  $\pm 1$  inch.
2. Depth of Truss Bars:  $+0, - 1/2$  inch.
3. Stirrups, Ties, and Spirals:  $\pm 1/2$  inch.
4. All Other Bends:  $\pm 1$  inch.

### 3.3 PLACING

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing and tying reinforcement.

- B. Reinforcement steel shall be accurately positioned as indicated and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) may be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties which are embedded in the blocks. For concrete over formwork, furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

- C. Limitations on the use of bar support materials shall be as follows.

1. Concrete Dobies: Permitted at all locations except in elevated concrete slabs and where architectural finish is required.
2. Wire Bar Supports: Permitted only at slabs over dry areas, interior dry wall surfaces, and exterior wall surfaces.
3. Plastic Bar Supports: Permitted at all locations except on grade.

- D. Tie wires shall be bent away from the forms in order to provide the indicated concrete coverage.

- E. Bars additional to those shown which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position shall be provided by the Contractor at no increased cost to the Owner.

- F. Unless otherwise indicated, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

- G. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar diameter, or enough to

exceed the above tolerances, the resulting arrangement of bars shall be as acceptable to the Engineer.

- H. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.
- I. Clean reinforcement of loose rust and mill scale, soil, ice, oils and other foreign materials.

### 3.4 SPACE OF BARS

- A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.
- B. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

### 3.5 SPLICING

- A. General: Reinforcement bar splices shall only be used at locations indicated. When it is necessary to splice reinforcement at other locations, the character of the splice shall be as acceptable to the Engineer.
- B. Splices of Reinforcement:
  - 1. The length of lap for reinforcement bars, unless otherwise shown shall be in accordance with ACI 318-14, Section 25.5.2 for a Class B splice.
- C. Bending or Straightening: Reinforcement shall not be straightened or rebent in a manner which will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by the Engineer. No bars partially embedded in concrete shall be field-bent except as indicated or specifically permitted by the Engineer.

### 3.6 CLEANING AND PROTECTION

- A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.
- B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be reinspected and, if necessary recleaned.

### 3.7 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS (Where Approved)

#### A. Hole Preparation:

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.
2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.
3. The hole shall be drilled by methods which do not interfere with the proper bonding of epoxy.
4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.
5. The hole shall be blown clean with clean, dry compressed and loose particles.
6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that ensures that excess material will be expelled from the hole during dowel placement.
7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.
8. Underwater epoxy such as Hilti Hit-HY 200 or equal shall be used.

**END OF SECTION**



## SECTION 03300

### CAST-IN-PLACE CONCRETE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Reports* – see Appendix 1 of the Project Manual.
- B. ACI Publications as listed throughout. The Contractor must have a current copy of ACI SP-15 "Field Reference Manual" for concrete construction on site.

##### 1.2 SUMMARY

- A. The following types of concrete shall be covered in this Section:
  - 1. Structural Concrete: Concrete to be used in all cases except where noted otherwise in the Contract Documents.
  - 2. Sitework Concrete: Concrete to be used for curbs, gutters, catch basins, sidewalks, pavements, fence and guard post embedment, underground duct bank encasement and all other concrete appurtenant to electrical facilities unless otherwise shown.
  - 3. Lean Concrete: Concrete to be used for thrust blocks, anchor blocks, pipe trench cut-off blocks and cradles, where the preceding items are detailed on the Drawings as unreinforced. Concrete to be used as protective cover for dowels intended for future connection.
- B. The Contractor shall furnish all materials for concrete in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.
- C. Contractor shall perform Hydrostatic Tests and perform concrete repair work as outlined in this Section and in Section 2 "Pipes and Appurtenances".
- D. Related Sections include the following:
  - 1. Division 03200 – "Reinforcement Steel".
  - 2. Division 03100 – "Concrete Formwork".
  - 3. Division 03315 – "Grout".

##### 1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Commercial Standards:
  - 1. ACI 117 - Standard Tolerances for Concrete Construction and Materials.
  - 2. ACI 214 - Recommended Practice for Evaluation of Strength Test Results of Concrete.
  - 3. ACI 301 - Specifications for Structural Concrete for Buildings.
  - 4. ACI 304.2R - Placing Concrete by Pumping Methods.

5. ACI 305R - Hot Weather Concreting.
6. ACI 306.1 - Standard Specification for Cold Weather Concreting.
7. ACI 309 - Consolidation of Concrete.
8. ACI 315 - Details and Detailing of Concrete Reinforcement.
9. ACI 318 - Building Code Requirements for Structural Concrete.
10. ACI 350 – Code Requirements for Environmental Concrete Structures.
11. ACI 350.1 – Hydrostatic Test, HST, for Open or Covered Tanks.
12. ASTM C 31 - Practice for Making and Curing Concrete Test.
13. ASTM C 33 - Specimens in the Field, Specification for Concrete Aggregates.
14. ASTM C 39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
15. ASTM C 94 - Specification for Ready-Mixed Concrete.
16. ASTM C 138 - Test Method for Unit Weight, Yield, and Air Content of Concrete.
17. ASTM C 143 - Test Method for Slump of Hydraulic Cement Concrete.
18. ASTM C 150 - Specification for Portland Cement.
19. ASTM C 156 - Test Method for Water Retention by Concrete Curing Materials.
20. ASTM C 231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
21. ASTM C 260 - Specification for Air-Entraining Admixtures for Concrete.
22. ASTM C 494 - Specification for Chemical Admixtures for Concrete.
23. ASTM E 1745 - Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

#### 1.4 SUBMITTALS

- A. Mix Designs: Prior to beginning the Work and within 14 days of the notice to proceed, submit to the Engineer, for review, preliminary concrete mix designs which shall show the proportions and gradations of all materials proposed for each class and type of concrete specified herein in accordance with Section 01300 "Submittals. All costs related to such checking shall be borne by the Contractor at no increased cost to the Owner.
  1. Concrete mix designs shall be submitted along with previous compressive strength test data showing compliance in accordance with ACI 318-14 Chapter 26. If historical mix design test data is not available for these concrete mixes, trial batch mixing shall be performed in accordance with the requirements for concrete for hydraulic structures.
- B. Delivery Tickets (Submitted upon request): Where ready-mix concrete is used, furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the state certified equipment used for measuring and the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the mix number, total yield in cubic yards, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.
- C. Furnish the following submittals in accordance with ACI 301 and as required herein:
  1. Mill tests for cement and fly ash.
  2. Admixture certification. Chloride ion content must be included.
  3. Aggregate gradation and certification demonstrating conformance to ASTM C 33 and this Section.

- a. Data submitted shall be obtained from tests performed within three months of the starting date of the Trial Batch and Laboratory Test.
- b. Data shall demonstrate compliance with paragraph 2.1.D.3 below.
- 4. Materials and methods for curing (include both hot and cold weather provisions).

D. Concrete testing agency qualifications.

## 1.5 QUALITY ASSURANCE

- A. **Installer Qualifications:** An experienced and qualified installer who has completed concrete Work 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.
- B. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.
  - 1. Manufacturer must be certified according to the National Ready Mixed Concrete Association's Certification of Ready Mixed Concrete Production Facilities.
- C. **Testing Agency Qualifications:** An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
  - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician - Grade 1, according to ACI CP-01 or an approved equivalent certification program.
  - 2. Personnel performing laboratory tests shall be ACI Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI Concrete Laboratory Testing Technician - Grade II.
- D. **Testing Agency for Trial Mixes and Shrinkage Tests:** An independent testing agency qualified and certified to perform the specified concrete tests.
- E. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.
- F. **Testing:**
  - 1. **General:**
    - a. Tests on component materials and for compressive strength and shrinkage of concrete will be performed as specified herein. Test for determining slump will be in accordance with the requirements of ASTM C 143.
    - b. Concrete for testing shall be supplied by the Contractor at no cost to the Owner, and the Contractor shall provide assistance to the Engineer in obtaining samples, and disposal and cleanup of excess material.
    - c. The Contractor will be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications. The laboratory must meet or exceed the requirements of ASTM C 1077.
  - 2. **Field Compression Tests:**
    - a. Compression test specimens will be taken during construction from the first placement of each class of concrete specified herein and at intervals thereafter as specified in Section 3.16 "Field Quality Control" to ensure continued compliance

with these Specifications. Samples for concrete testing shall be taken at point of placement. Each set of test specimens will be a minimum of two sets of two cylinders.

- b. Compression test specimens for concrete shall be made in accordance with section 9.2 of ASTM C 31. Specimens shall be 6-inch diameter by 12-inch high cylinders or 4-inch diameter by 8-inch high cylinders. Specimens shall be tested using the proper sized compression plates for the specimen diameter.
  - c. Compression tests shall be performed in accordance with ASTM C 39.
  - d. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
3. Evaluation and Acceptance of Concrete:
- a. Evaluation and acceptance of the compressive strength of concrete shall be according to the requirements of ACI 318, Chapter 26 "Concrete Quality," and as specified herein.
  - b. A statistical analysis of compression test results will be performed according to the requirements of ACI 214. The standard deviation of the test results shall not exceed 640 psi, when ordered at equivalent water content as estimated by slump.
  - c. If any concrete fails to meet these requirements, immediate corrective action shall be taken to increase the compressive strength for all subsequent batches of the type of concrete affected.
  - d. When the standard deviation of the test results exceeds 640 psi, the average strength for which the mix is designed shall be increased by an amount necessary to satisfy the statistical requirement that the probability of any test being more than 500 psi below or the average of any three consecutive tests being below the specified compressive strength is 1 in 100. The required average strength shall be calculated by Criterion No. 3 of ACI 214 using the actual standard of deviation.
  - e. All concrete which fails to meet the ACI requirements and these Specifications, is subject to removal and replacement at no increase in cost to the Owner.

G. Construction Tolerances: Set and maintain concrete forms and perform finishing operations so as to ensure that the completed Work is within the tolerances specified herein. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances. Tolerance is the specified permissible variation from lines, grades, or dimensions shown. Where tolerances are not stated in the Specifications, permissible deviations will be in accordance with ACI 117.

1.

The following non-cumulative construction tolerances are hereby established and apply to finished walls and slab unless otherwise shown:

<u>Item</u>	<u>Tolerance</u>
Variation of the constructed linear outline from the established position in plan.	in 10 feet: 1/4 inch; In 20 feet or more: 1/2 inch
Variation from the level or from the grades shown.	in 10 feet: 1/4 inch; In 20 feet or more: 1/2 inch
Variation from the plumb.	In 10 feet: 1/4 inch; In 20 feet or more: 1/2 inch

Variation in the thickness of slabs  
and walls.

Minus 1/4 inch;  
Plus 1/2 inch

Variations in the locations and sizes of  
slabs and wall openings.

Plus or Minus 1/4 inch

## **PART 2 - PRODUCTS**

### **2.1 CONCRETE MATERIALS**

#### **A. General:**

1. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Only one brand of cement shall be used. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

#### **B. All materials furnished for the Work shall comply with the requirements of Sections 201, 203, and 204 of ACI 301, as applicable.**

#### **C. Storage of materials shall conform to the requirements of Section 205 of ACI 301, Sections 501.03.02 and 501.03.03 or the Standard Specifications.**

#### **D. Materials for concrete shall conform to the following requirements:**

1. Cement shall be standard brand portland cement conforming to ASTM C 150 for Type II.
2. Fly Ash: At the contractor's option, fly ash may be incorporated into the concrete mix designs at a maximum rate of 25% of the cementitious material by weight. Fly ash shall conform to ASTM C 618, Class F, except loss on ignition less than 1.0 percent and calcium oxide content less than 30 percent.
3. Water for mixing and curing shall be potable and meet ASTM C94.
4. Aggregates shall be obtained from pits acceptable to the Engineer, shall be nonreactive, and shall conform to the requirements of ASTM C 33, Class 3S coarse aggregate or better, graded. Maximum size of coarse aggregate shall be 1 inch or 3/4inch nominal. Lightweight sand for fine aggregate will not be permitted.
5. Ready-mix concrete shall conform to the requirements of ASTM C 94.
6. Admixtures: All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, discontinue use of the admixture. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be nontoxic after 30 days.
  - a. Air-entraining agent meeting the requirements of ASTM C 260, shall be used. Sufficient air-entraining agent shall be used to provide a total air content within the ranges indicated in section 2.5 C. The Engineer and/or Owner reserves the right, at any time, to sample and test the air- entraining agent received on the job. The air-entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement. Air content shall be tested at the point of placement.
  - b. Set controlling and water reducing admixtures: Admixtures may be added at the Contractor's option to control the set, effect water reduction, and increase workability. The addition of an admixture shall be at no increase in cost to the Owner. The use of an admixture shall be subject to acceptance by the Engineer.

Concrete containing an admixture shall be first placed at a location determined by the Engineer. Admixtures specified herein shall conform to the requirements of ASTM C 494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

- 1) Concrete shall not contain more than one water reducing admixture. Concrete containing an admixture shall be first placed at a location determined by the Engineer.
- 2) Set controlling admixture shall be either with or without water- reducing properties. Where the air temperature at the time of placement is expected to be consistently over 80 degrees F, a set retarding admixture may be used. Where the air temperature at the time of placement is expected to be consistently under 40 degrees F, a noncorrosive, set-accelerating admixture may be used.
- 3) Normal range water reducer shall conform to ASTM C 494, Type A. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.
- 4) High range water reducer shall conform to ASTM C 494, Type F or G. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.
- 5) If the high range water reducer is added to the concrete at the jobsite, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches +/- 1/2 inch prior to adding the high range water reducing admixture at the jobsite. The high range water reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the jobsite system.
- 6) Concrete shall be mixed at mixing speed for a minimum of 70 mixer revolutions or 5 minutes after the addition of the high range water reducer.

## 2.2 CURING MATERIALS

- A. Materials for curing concrete as specified herein shall conform to the following requirements, ASTM C 156, and ASTM C 309:
  1. All curing compounds shall be white pigmented and resin based. Sodium silicate compounds shall not be allowed.
  2. Polyethylene sheet for use as concrete curing blanket shall be white, and shall have a nominal thickness of 6 mils. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, having a nominal thickness of 2 mils and permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (1) (2).
  3. Polyethylene-coated burlap for use as concrete curing blanket shall be 4 mils thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard: Curing mats for use as specified herein, shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

4. Evaporation retardant shall be compatible with any admixtures used in the fresh concrete mix.

## 2.3 NONWATERSTOP JOINT MATERIALS

- A. Materials for nonwaterstop joints in concrete shall conform to the following requirements:
  1. Preformed joint filler shall be a nonextruding, resilient, bituminous type conforming to the requirements of ASTM D 1751.
  2. Elastomeric joint sealer shall conform to the requirements of Section 07920 - Sealants and Caulking.
  3. Mastic joint sealer shall be a material that does not contain evaporating solvents; that will tenaciously adhere to concrete surfaces; that will remain permanently resilient and pliable; that will not be affected by continuous presence of water and will not in any way contaminate potable water; and that will effectively seal the joints against moisture infiltration even when the joints are subject to movement due to expansion and contraction. The sealer shall be composed of special asphalts or similar materials blended with lubricating and plasticizing agents to form a tough, durable mastic substance containing no volatile oils or lubricants and shall be capable of meeting the test requirements set forth hereinafter, if testing is required by the Engineer.

## 2.4 MISCELLANEOUS MATERIALS

- A. Bonding agents shall be epoxy adhesives conforming to the following products for the applications specified:
  1. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; Concessive Liquid (LPL), as manufactured by Master Builders; BurkEpoxy MV as manufactured by The Burke Company; or equal.
  2. For bonding hardened concrete to steel, Sikadur 31 Hi-Mod Gel as manufactured by Sika Corporation; BurkEpoxy NS as manufactured by The Burke Company; Concessive Paste (LPL) as manufactured by Master Builders; or equal.

## 2.5 CONCRETE DESIGN REQUIREMENTS

- A. General: Concrete shall be composed of cement, admixtures, aggregates and water. These materials shall be of the qualities specified. The exact proportions in which these materials are to be used for different parts of the Work will be determined by the trial batch for hydraulic structures and previous mix designs and test data for all other classes of concrete unless previous test data is unavailable. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to the Owner. All changes shall be subject to review by the Engineer.
- B. Fine Aggregate Composition: In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight, shall be as indicated in the following table. For other

concrete, the maximum percentage of fine aggregate of total aggregate, by weight, shall not exceed 50.

<u>Fine Aggregate</u>	
<u>Fineness Modulus</u>	<u>Maximum Percent</u>
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.1	44

- C. Water-Cement Ratio and Compressive Strength: The minimum compressive strength and cement content of concrete shall be not less than that specified in the following tabulation.

<u>Type of Work</u>	<u>Min 28-Day Compressive Strength (psi)</u>	<u>Max Agg. Size (in)</u>	<u>Minimum Cement (lb/yd<sup>3</sup>)</u>	<u>Max w/c (by weight)</u>
Class "A" (WTB Slab on Grade)	6,000	3/4	550	0.42
Class "B" (Building Foundations & Support)	4,000	3/4	550	0.45
Class "C" (Sitework Concrete)	4,000	1	550	0.45
Lean Concrete	2,500	1 1/2	376	0.60

Note: The Contractor is cautioned that the limiting parameters specified above are not a mix design. Additional cement, water reducing agent, or mix designs may be required to achieve workability demanded by the Contractor's construction methods and aggregates. The Contractor is responsible for any costs associated with furnishing concrete with the required workability.

- D. Adjustments to Mix Design: The mixes used shall be changed whenever such change is necessary or desirable to secure the required strength, density, workability, and surface finish and the Contractor shall be entitled to no additional compensation because of such changes.

## 2.6 CONSISTENCY

- A. The quantity of water entering into a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation, and which can be compacted by the vibratory methods herein specified to give the desired density, impermeability and smoothness of surface. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C 143. The slumps shall be as follows:



<u>Type of Work</u>	<u>Slump (in)</u>
All Concrete, unless noted otherwise	4 inches, plus or minus 1 inch
With high-range water reducer added	7 inches, plus or minus 2 inches

## 2.7 LABORATORY TESTS

- A. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C 192 and ASTM C 39. Three compression test cylinders will be tested at 7 days, 3 at 14 days, and 3 at 28 days. The average compressive strength for the three cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.
- B. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C 136. Values shall be given for percent passing each sieve. Fine and coarse aggregate shall be tested for compliance with ASTM C 33 and as required herein.
- C. Cement shall be tested for compliance with ASTM C 150 and as required herein.
- D. See Section 1.6 "Quality Assurance" for qualified testing agency concrete trial batches and shrinkage tests.

## 2.8 READY-MIXED CONCRETE

- A. At the Contractor's option, ready-mixed concrete may be used meeting the requirements as to materials, batching, mixing, transporting, and placing as specified herein and in accordance with ASTM C 94, including the following supplementary requirements.
- B. Each batch of ready-mixed concrete delivered at the job site shall be accompanied by a delivery ticket furnished to the Engineer in accordance with the paragraph in Part 1 entitled "Delivery Tickets."
- C. The use of nonagitating equipment for transporting ready-mixed concrete will not be permitted. Combination truck and trailer equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by the Engineer.

## 2.9 LIQUID SLAB SURFACE TREATMENTS (SURFACE APPLIED CONCRETE SEALANT)

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
  - 1. Remove oil, dirt, laitance, and other contaminants and complete surface repairs.
  - 2. Do not apply until concrete has cured at least 28 days.
  - 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner to provide a smooth and non-porous surface.

## 2.10 FLOOR HARDENER (SURFACE APPLIED)

- A. Surface hardener shall be a light reflective nonoxidizing metallic aggregate dry shake surface hardener.
  - 1. Surface hardener shall be premeasured, premixed and packaged at the factory.
  - 2. Apply surface hardener at the manufacturer's suggested rate for type of application.
- B. Curing Compound shall meet the moisture retention requirements of ASTM C 309 and surface hardener manufacturer's recommendations.
- C. Monomolecular Film: Evaporation retarder shall be used to aid in maintaining concrete moisture during the early placement stages of plastic concrete. Evaporation retarder shall be as recommended by surface hardener manufacturer.

## PART 3 - EXECUTION

### 3.1 PROPORTIONING AND MIXING

- A. Proportioning: Proportioning of the concrete mix shall conform to the requirements of Chapter 3 "Proportioning" of ACI 301.
- B. Mixing: Mixing of concrete shall conform to the requirements of Chapter 7 of said ACI 301 Specifications.
- C. Slump: Maximum slumps shall be as specified herein.
- D. Retempering: Retempering of concrete or mortar which has partially hardened shall not be permitted.

### 3.2 PREPARATION OF SURFACES FOR CONCRETING

- A. General: Earth surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- B. Joints in Concrete: Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by the Engineer, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints. The surfaces of horizontal joints shall be given a compacted, roughened surface for good bond. The joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and roughened to a minimum 1/4- inch amplitude.
- C. Placing Interruptions: When placing of concrete is to be interrupted long enough for the concrete to take a set, the working face shall be given a shape by the use of forms or other means, that will secure proper union with subsequent Work; provided that construction joints shall be made only where acceptable to the Engineer.

- D. Embedded Items: No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by the Engineer at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from concrete previously placed shall be cleaned of all such grout before the surrounding or adjacent concrete is placed.
- E. All inserts or other embedded items shall conform to the requirements herein.
- F. All reinforcement, anchor bolts, sleeves, inserts, and similar items shall be set and secured in the forms where shown or by shop drawings and shall be acceptable to the Engineer before any concrete is placed. Accuracy of placement is the responsibility of the Contractor.
- G. Casting New Concrete Against Old: Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by the Engineer.
- H. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the Work. No concrete shall be deposited underwater nor shall the Contractor allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the Engineer.
- I. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.
- J. Openings for pipes, inserts for pipe hangers and brackets, and the setting of anchors shall, where practicable, be provided for during the placing of concrete.
- K. Anchor bolts shall be accurately set, and shall be maintained in position by templates while being embedded in concrete.
- L. Cleaning: The surfaces of all metal work to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed.

### 3.3 CONDUITS AND PIPES EMBEDDED IN CONCRETE FLOORS, WALLS AND ROOFS OF STRUCTURES

- A. Conduits, pipes, and sleeves of any material not harmful to concrete and within limitations of this Section shall be permitted to be embedded in concrete with approval of the Engineer, provided they are not considered to replace structurally the displaced concrete.

- B. Conduits and pipes of aluminum shall not be embedded in structural concrete unless effectively coated or covered to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
- C. Conduits, pipes, and sleeves passing through a slab, wall, or beam shall not impair significantly the strength of the construction.
- D. Except when drawings for conduits and pipes are approved by the Engineer conduits and pipes embedded within a slab, wall, or beam (other than those merely passing through) shall satisfy the following:
  - 1. They shall not be larger in outside dimension than  $1/3$  the overall thickness of slab, wall, or beam in which they are embedded.
  - 2. They shall not be spaced closer than 3 diameters or widths on center.
  - 3. They shall not impair significantly the strength of the construction.
- E. Conduits, pipes, and sleeves shall be permitted to be considered as replacing structurally in compression the displaced concrete provided:
  - 1. They are not exposed to rusting or other deterioration.
  - 2. They are of uncoated or galvanized iron or steel not thinner than standard Schedule 40 steel pipe.
  - 3. They have a nominal inside diameter not over 2-inches and are spaced not less than 3 diameters on centers.
- F. Pipes and fittings shall be designed to resist effects of the materials, pressure, and temperature to which they will be subjected.
- G. No liquid, gas, or vapor, except water not exceeding 90 F nor 50 psi pressure, shall be placed in the pipes until the concrete has attained its design strength.
- H. Concrete cover for pipes, conduits, and fittings shall not be less than 1-1/2 inch for concrete exposed to earth or weather, nor 3/4 inch for concrete not exposed to weather or in contact with ground.
- I. Reinforcement with an area not less than 0.002 times area of concrete section shall be provided normal to piping.
- J. Piping and conduit shall be so fabricated and installed that cutting, bending, or displacement of reinforcement from its proper location will not be required.

### 3.4 HANDLING, TRANSPORTING, AND PLACING

- A. General: Placing of concrete shall conform to the applicable requirements of Chapter 8 of ACI 301 and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.
- B. Nonconforming Work or Materials: Concrete which upon or before placing is found not to conform to the requirements specified herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with these Specifications, or which is of inferior quality, shall be removed and replaced at no additional expense to the Owner.

- C. Unauthorized Placement: No concrete shall be placed except in the presence of duly authorized representative of the Engineer. Notify the Engineer in writing at least 24 hours in advance of placement of any concrete.
- D. Placement in Wall Forms: Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In such cases, some means such as the use of hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation. In no case shall the free fall of concrete exceed 4 feet below the ends of ducts, chutes, or buggies. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction. Concrete in forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members. Each layer shall be placed while the previous layer is still soft. The rate of placing concrete in forms shall not exceed 5 feet of vertical rise per hour. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.
- E. Casting New Concrete Against Old: An epoxy adhesive bonding agent shall be applied to the old surfaces according to the manufacturer's written recommendations. This provision shall not apply to joints where waterstop is installed.
- F. Conveyor Belts and Chutes: All ends of chutes, hopper gates, and all other points of concrete discharge throughout the Contractor's conveying, hoisting and placing system shall be so designed and arranged that concrete passing from them will not fall separated into whatever receptacle immediately receives it. Conveyor belts, if used, shall be of a type acceptable to the Engineer. Chutes longer than 50 feet will not be permitted. Minimum slopes of chutes shall be such that concrete of the specified consistency will readily flow in them. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted. All conveyor belts and chutes shall be covered.
- G. Placement in Slabs: Concrete placed in sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement. As the Work progresses, the concrete shall be vibrated and carefully worked around the slab reinforcement, and the surface of the slab shall be screeded in an up-slope direction.
- H. Temperature of Concrete: The temperature of concrete when it is being placed shall be not more than 90 degrees F nor less than 55 degrees F for sections less than 12 inches thick nor less than 50 degrees for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the specified minimum temperature. When the temperature of the concrete is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, the Contractor shall employ effective means, such as precooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. The Contractor shall be entitled to no additional compensation on account of the foregoing requirements.
- I. Cold Weather Placement:

1. Placement of concrete shall conform to ACI 306.1 - Standard Specification for Cold Weather Concreting, and the following.
2. Remove all snow, ice and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches. All reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.
3. Maintain the concrete temperature above 50 degrees F for at least 3 days after placement.

J. Hot Weather Placement:

1. Placement of concrete shall conform to ACI 305R - Hot Weather Concreting, and the following.
2. Only set retarding admixture shall be used in concrete when air temperature is expected to be consistently over 80 degrees F.
3. The maximum temperature of concrete shall not exceed 90 degrees F immediately before placement.
4. From the initial placement to the curing state, concrete shall be protected from the adverse effect of high temperature, low humidity, and wind.

### 3.5 PUMPING OF CONCRETE

- A. General: If the pumped concrete does not produce satisfactory end results, discontinue the pumping operation and proceed with the placing of concrete using conventional methods.
- B. Pumping Equipment: The pumping equipment must have two cylinders and be designed to operate with one cylinder only in case the other one is not functioning. In lieu of this requirement, the Contractor may have a standby pump on the site during pumping.
- C. The minimum diameter of the hose (conduits) shall be in accordance with ACI 304.2R.
- D. Pumping equipment and hoses (conduits) that are not functioning properly shall be replaced.
- E. Aluminum conduits for conveying the concrete shall not be permitted.
- F. Field Control: Concrete samples for slump, air content, and test cylinders will be taken at the placement (discharge) end of the line.

### 3.6 ORDER OF PLACING CONCRETE

- A. The order of placing concrete in all parts of the Work shall be acceptable to the Engineer. In order to minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints shown. The placing of units shall be done by placing alternate units in a manner such that each unit placed shall have cured at least 7 days for hydraulic structures and 3 days for all other structures before the contiguous unit or units are placed.

### 3.7 TAMPING AND VIBRATING

- A. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense,

homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete during placement. Vibrators shall be Group 3 (per ACI 309) high-speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient number and with (at least one) standby units as required. Group 2 vibrators may be used only at specific locations when accepted by the Engineer.

- B. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure that all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure that all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration, over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.
- C. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly as specified. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the results herein specified within 15 minutes after concrete of the prescribed consistency is placed in the forms. Care shall be taken not to vibrate concrete excessively -or to work- it in any manner that causes segregation of its constituents.

### 3.8 FINISHING CONCRETE SURFACES

- A. General: Surfaces shall be free from fins, bulges, ridges, offsets, honeycombing, or roughness of any kind, and shall present a finished, smooth, continuous hard surface. Allowable deviations from plumb or level and from the alignment, profiles, and dimensions shown are defined as tolerances and are specified in Part 1, herein. These tolerances are to be distinguished from irregularities in finish as described herein. Aluminum finishing tools shall not be used.
- B. Formed Surfaces: No treatment is required after form removal except for curing, repair of defective concrete, and treatment of surface defects. Where architectural finish is required, it shall be as specified or as shown.
  - 1. Surface holes larger than 1/2 inch in diameter or deeper than 1/4-inch are defined as surface defects in basins and exposed walls.
- C. Unformed Surfaces: After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each Work operation as necessary to prevent drying shrinkage cracks. The classes of finish specified for unformed concrete surfaces are designated and defined as follows:
  - 1. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8 inch. No further special finish is required.
  - 2. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating

shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where shown or as determined by the Engineer.

3. Finish U3 - After the floated surface (as specified for Finish U2) has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.
4. Finish. U4 - Steel trowel finish (as specified for Finish U3) without local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise shown. The resulting surface shall be rough enough to provide a nonskid finish.

D. Unformed surfaces shall be finished according to the following Schedule:

### 3.9 UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material.	U1
Floors to be covered with grouted tile or topping grout.	U2
Slabs which are water bearing with slopes 10% and less.	U3
Sloping slabs which are water bearing with slopes greater than 10%.	U4
Slabs not water bearing.	U4
Interior slabs and floors to receive architectural finish.	U3
Top surface of exposed walls.	U3

A. Floor Hardener (Surface Applied):

1. Where hardener for floors is indicated, provide concrete with the following additional requirements:
  - a. Maximum slump of 4 inches when peak ambient temperatures are expected to be more than 65 degrees F, and no more than 3 inches when ambient temperatures are below 65 degrees F.
  - b. Maximum air content of 3 percent.
  - c. Do not use calcium chloride or set-accelerating admixtures containing calcium chloride.
  - d. Do not use admixtures that increase bleeding.
  - e. Do not use fly ash unless fly ash is shown to not negatively impact the selected manufacturer's surface applied hardener.
2. After the concrete has been leveled and as soon as the concrete will support an operator and machine without disturbing the level or working up excessive fines, float the surface of the slab with a mechanical float fitted with float shoes. Following floating, apply 1/2 to 2/3 of the total amount of dry shake surface hardener so that a uniform distribution of surface hardener is obtained. The use of a mechanical spreader is recommended. Once the shake has absorbed sufficient moisture (indicated by the darkening of the shake), float the surface. Immediately apply the remaining 1/3 to 1/2 of the shake and allow to absorb moisture. Do not place dry shake on concrete surface when bleed water is present.
3. Use finishing machines with detachable float shoes. Compact surface by a third mechanical floating if time and setting characteristics of the concrete will allow. Do not add water to the surface.



4. As surface further stiffens, indicated by loss of sheen, hand or mechanically trowel with blades set relatively flat. Remove all marks and pinholes in the final raised trowel operation.
5. Follow all application instructions of the floor surface hardener manufacturer.
6. Cure finished floors using fill-forming curing compound recommended by surface hardener manufacturer. Uniformly apply curing compound over the entire surface at a coverage that will provide moisture retention in excess of the requirements of ASTM C 309. Maintain ambient temperature of 50 degrees F or above during the curing period.
7. Keep floors covered and free of traffic and loads for a minimum of 10 days after completion.

### 3.10 CURING AND DAMPROOFING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- C. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
  1. Moisture Curing: Keep surfaces continuously moist for not less than 10 days with the following materials:
    - a. Water.
    - b. Continuous water-fog spray.
    - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
  2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
    - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.

### 3.11 PROTECTION

- A. Protect all concrete against injury until final acceptance by the Owner.
- B. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic and whenever such precipitation is imminent or occurring.

### 3.12 CURING IN COLD WEATHER

- A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the worksite is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.
- B. Concrete cured by an application of curing compound will require no additional protection from freezing if the protection at 50 degrees F for 72 hours is obtained by means of approved insulation in contact with the forms or concrete surfaces; otherwise the concrete shall be protected against freezing temperatures for 72 hours immediately following 72 hours protection at 50 degrees F. Concrete cured by water curing shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.
- C. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72 hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided, that the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.
- D. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Use of unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by application of curing compound; provided, that the use of curing compound for such surfaces is otherwise permitted by these Specifications.

### 3.13 TREATMENT OF SURFACE DEFECTS

- A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by the Engineer. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall have them repaired as specified herein. Concrete containing extensive voids, holes, honeycombing, or similar depression defects, shall be completely removed and replaced. All repairs and replacements herein specified shall be promptly executed by the Contractor at its own expense.
- B. Defective surfaces to be repaired shall be cut back from true line a minimum depth of 1/2 inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, and not less than 1/32-inch depth of the surface film from all hard portions, by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces under repair will remain moist, but not so wet as to overcome the suction upon which a good bond depends. The material used for repair proposed shall consist of a mixture of one sack of cement to 3 cubic feet of sand. For exposed walls, the cement shall contain

such a proportion of Atlas white portland cement as is required to make the color of the patch match the color of the surrounding concrete.

- C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. These holes then shall be repaired in an approved manner with dry-packed cement grout. Holes left by form-tying devices having a rectangular cross-section, and other imperfections having a depth greater than their least surface dimension, shall not be reamed but shall be repaired in an approved manner with dry-packed cement grout.
- D. All repairs shall be built up and shaped in such a manner that the completed Work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of said repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.
- E. Prior to filling any structure with water, all cracks that may have developed shall be "vee'd" as shown and filled with sealant conforming to the requirements of Section 03290 - Joints in Concrete. This repair method shall be done on the water bearing face of members. Prior to backfilling, faces of members in contact with fill, which are not covered with a waterproofing membrane, shall also have cracks repaired as specified herein.

### 3.14 PATCHING HOLES IN CONCRETE

- A. Patching Small Holes:
  - 1. Holes which are less than 12 inches in their least dimension and extend completely through concrete members, shall be filled as specified herein.
  - 2. Small holes in members which are water-bearing or in contact with soil or other fill material, shall be filled with nonshrink grout where a face of the member is exposed to view, the nonshrink grout shall be held back 2 inches from the finished surface. The remaining 2 inches shall then be patched according to the paragraph in Part 3 entitled "Treatment of Surface Defects."
  - 3. Small holes through all other concrete members shall be filled with nonshrink grout, with exposed faces treated as above.
- B. Patching Large Holes:
  - 1. Holes which are larger than 12 inches in their least dimension, shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as specified herein.
  - 2. Holes which are larger than 24 inches in their least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in grout in drilled holes. The reinforcing added shall match the reinforcing in the existing wall unless shown.
  - 3. Large holes in members which are water bearing or in contact with soil or other fill, shall have a bentonite type waterstop material placed around the perimeter of the hole as specified in the Section 03290 - Joints in Concrete, unless there is an existing waterstop in place.

### 3.15 FIELD QUALITY CONTROL

- A. Testing and Inspection Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and inspections, and submit reports. Sampling and testing for quality control includes items specified below.
  - 1. The Engineer shall review and approve the Testing Agency qualifications.
  - 2. The Contractor must advise the Testing and Inspection Agency at least 36 hours in advance of concrete placement.
  - 3. Inspection tasks are outlined in Structural General Notes on Plans. See also "Special Inspections" in the Project Manual.
- B. Concrete Testing: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
  - 1. Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 10 cu. yd.
    - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mix, testing shall be conducted from at least five randomly selected batches.
  - 2. Testing Location: Final fresh concrete properties shall be tested and recorded or samples taken at point of use; i.e. test materials as placed after all methods of transportation.
  - 3. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
  - 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample at point of placement, but not less than one test for each day's pour of each concrete mix.
  - 5. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4.4 deg C) and below or when 80 deg F (27 deg C) and above, and one test for each composite sample.
  - 6. Unit Weight: ASTM C 567, fresh unit weight of concrete; one test for each composite sample at point of placement but not less than one test for each day's pour of each concrete mix.
  - 7. Compression Test Specimens: ASTM C 31/C 31M; cast; from material at point of placement, and laboratory cure two sets of two standard cylinder specimens for each composite sample.
- C. The concrete testing Technician must immediately inform the Contractor's Project Superintendent of sample test results.
  - 1. Concrete incorporated in the Work that does not comply with all specified fresh concrete properties is subject to rejection and replacement at the Contractor's expense.
- D. Test results shall be reported in writing to Engineer, Concrete Manufacturer, and Contractor within 48 hours of testing. Reports of tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work by grid designation and elevation, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for 28 day tests.
- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements

have not been met, as directed by Engineer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as approved by the Engineer.

- G. Owner may also engage a second, independent Testing Agency to verify concrete test results. This independent Testing Agency shall meet all of the requirements of this Specification and shall also have access to the project site and materials as detailed in this Specification.

### 3.16 CARE AND REPAIR OF CONCRETE

- A. Protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance by the Owner. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed Work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at the Contractor's expense.

**END OF SECTION**

## **SECTION 03315**

### **GROUT**

#### **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. Nonshrink Grout: This type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.
  - 2. Cement Grout.
  - 3. Epoxy Grout.
  - 4. Pump and Motor Grout.
  - 5. Topping Grout and Concrete Fill.
- B. Related Requirements:
  - 1. Section 03300 - "Cast-in-Place Concrete".

##### **1.3 INFORMATION SUBMITTALS**

- A. Submit certified test results verifying the compressive strength, shrinkage, and expansion requirements indicated herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of nonshrink and epoxy grout used in the Work.
- B. Provide Manufacturer's independent certification of ASTM C1107, "Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)," compliance without modification of the standard methods certifying that the Class B or C grouts post hardening non-shrink properties are not based on gas expansion, grouts have strengths of 3500 psi at 1 day, 6500 psi at 14 days and 7500 psi at 28 days when cured at 72 degrees F as well as meeting the 3, 7 and 28 day strengths when tested and cured at the 45 degree and 95 degree limits and all other requirements of ASTM C 1107.

##### **1.4 QUALITY ASSURANCE**

- A. Field Tests:
  - 1. Compression test specimens will be taken during construction from the first placement of each type of grout. The specimens will be made by the Engineer or its representative.
  - 2. Compression tests and fabrication of specimens for cement grout and nonshrink grout will be performed as specified in ASTM C 109 at intervals during construction as

- selected by the Engineer. A set of three specimens will be made for testing at 7 days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the Engineer. A set of three specimens will be made for testing at 7 days, and each earlier time period as appropriate.
  4. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.
  5. The Cost of all laboratory tests on grout will be borne by the Owner, but the Contractor shall assist the Engineer in obtaining specimens for testing. However, the Contractor shall be responsible, without additional cost to the Owner, for the cost of any additional tests and investigation on work performed which does not comply with the Specifications. The Contractor shall supply all materials necessary for fabricating the test specimens.
- B. Construction Tolerances: Construction tolerances shall be as specified in the Section 03300 - Cast-in-Place Concrete, except as modified herein and elsewhere in the Contract Documents.

## **PART 2 - PRODUCTS**

### **2.1 CEMENT GROUT**

- A. Cement Grout: Cement grout shall be composed of one-part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, white portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4,000 psi.
- B. Cement grout materials shall be as specified in Section 03300 "Cast-in-Place Concrete".

### **2.2 PREPACKAGED GROUTS**

- A. Nonshrink Grout
  1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Cement from kilns burning metal-rich hazardous waste fuel shall not be used. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout herein shall be that recommended by the manufacturer for the particular application. All grouts (Grade A, B, C) shall be tested for height change of the hardened grout at 1, 3, 14, and 28 days in accordance with ASTM C 1090, "Test Method for Measuring Change in Height of Cylindrical Specimens for Hydraulic-Cement Grout," and shall be tested for compression at 1, 3, 7, and 28 days in accordance with the modified ASTM C109 testing procedure.
  2. Application:
    - a. Non-shrink grout shall be used for creating fillets in concrete channels, grouting under all equipment base plates, and at all locations where grout is required by the Contract Documents except where epoxy grout is specifically required. .

B. Epoxy Grout:

1. Epoxy grout shall be a pourable, nonshrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any nonreactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
2. Epoxy grouts proposed for use shall have documentation verifying that the components and integrity of the epoxy grout will not be adversely affected by the chemicals used in the treatment process.
3. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.
4. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.
5. The epoxy grout shall develop a compressive strength of 5,000 psi in 24 hours and 10,000 psi in 7 days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.
6. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by testing in accordance with ASTM C 1339, "Standard Test Method for Flowability and Bearing Area of Chemical-Resistant Polymer Machinery Grouts," for bearing area and flow.
7. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of  $30 \times 10^{-6}$  inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.
8. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications in the Contract Documents where grout type is not specifically indicated.

C. Grout for Pumps and Motors:

1. Grout for pumps and motors shall be epoxy grouts meeting the following minimum requirements:
  - a. Creep shall be less than 0.005 in/in when tested by ASTM C 1181 method. The test shall be at 70 degrees F and 140 degrees F with a load of 400 psi.
  - b. Linear shrinkage shall be less than 0.080 percent and thermal expansion less than  $17 \times 10^{-6}$  in/in/degree F when tested by ASTM C 531.
  - c. The compressive strength shall be a minimum of 12,000 psi in 7 days when tested by ASTM C 579 Method 8, modified.
  - d. Bond strength of grout to portland cement concrete shall be greater than 2,000 psi when using ASTM C 882 test method.
  - e. Grout shall pass the thermal compatibility test when overlayed on portland cement concrete using test method ASTM C 884.
  - f. Tensile strength and modulus of elasticity shall be determined by ASTM D 638. The tensile strength shall not be less than 1,700 psi and the modulus of elasticity shall not be less than  $1.8 \times 10^6$  psi.
  - g. Gel time and peak exothermic temperature shall be determined by ASTM D 2471. Peak exothermic temperature shall not exceed 110 degrees F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 150 minutes.



- h. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperatures as high as 150 degrees F, with a load of 2,000 psi.
  2. Primer, if required, shall conform to the written recommendations of the grout manufacturer.
  3. Surface preparations shall conform to the written recommendations of the grout manufacturer.
  4. Placement and Curing
    - a. Placement and curing procedures shall be in accordance with the written recommendations of the grout manufacturer.
    - b. A grouting performance demonstration/training session shall be conducted by the grout manufacturer's representative prior to foundation and baseplate preparation and the first grouting on site. This training session shall demonstrate proper preparation and installation methods and that the grouting material meets the strength requirements.
- D. Grout for Repair of Concrete:
  1. Grout for repair of concrete for vertical applications shall not produce a vapor barrier, shall be one component, reoplastic, cement based, fiber reinforced, shrinkage compensated, non-expansive, gray concrete product. The grout shall be sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water. The grout shall be free of chlorides and other chemicals causing corrosion with the following properties:
    - a. Minimum Slant Shear Bond Strength: 3000 psi in 28 days when tested in accordance with ASTM C882, modified.
    - b. Minimum Compressive strength: 11,000 psi in 28 days when tested in accordance with ASTM C109.
    - c. Minimum Direct Shear Bond Strength: 650 psi when at 28 days.
    - d. Minimum Tensile Bond Strength: 700psi in 28 days per ASTM C307.
    - e. Minimum Flexural Strength: 1300 psi when tested in accordance with ASTM C348.
    - f. Modules of Elasticity:  $5 \times 10^8$  psi when tested in accordance with ASTM C469.
    - g. Maximum Rapid Chloride Permeability: 772 coulombs when tested in accordance with ASTM C1202.
    - h. Manufacturers shall be Master Builders Technologies Co., EMACO.
  2. Grout for repair of concrete for horizontal and formed applications shall not produce a vapor barrier, shall be one component, reoplastic, cement based, fiber reinforced, shrinkage compensated, non-expansive, gray concrete product. The grout shall be flowable, extremely low permeability, sulfate resistant, easy to use and requiring only the addition of water. The grout shall be free of chlorides and other chemicals causing corrosion with the following properties:
    - a. Minimum Shear Bond Strength: 2150 psi in 7 days when tested in accordance with ASTM C1042.
    - b. Minimum Compressive Strength: 6000 psi in 7 days when tested in accordance with ASTM C109.
    - c. Minimum Flexural Strength: 770 psi in 28 days when tested in accordance with ASTM c 78.
    - d. Maximum Chloride Permeability: 1,000 coulombs when tested in accordance with ASTM C1202.
    - e. Minimum Modulus of Elasticity:  $4.8 \times 10^6$  psi when tested in accordance with ASTM C469.

- f. Manufacturers shall be Master Builders Technologies Co., EMACO S66-CR.

## 2.3 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03300 -Cast-in-Place Concrete for cement grout and as recommended by the manufacturer of prepackaged grouts.

## 2.4 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as indicated herein for the particular application.

## 2.5 MEASUREMENT OF INGREDIENTS

- A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.
- B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. All surface preparation, curing, and protection of cement grout shall be as indicated in Section 03300 - "Cast-in-Place Concrete". The finish of the grout surface shall match that of the adjacent concrete.
- B. The manufacturer of nonshrink grout and epoxy grout shall provide onsite technical assistance upon request.
- C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by the Engineer.

## 3.2 GROUTING PROCEDURES

- A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.
- B. Grout for Repair of Concrete:
  - 1. All repair shall be performed in accordance with the manufacturer's recommendations and with ICRI's Guideline No 03730, "Guide for Surface Preparation for the Repair of

Deteriorated Concrete Resulting from Reinforcing Steel Corrosion," and ICRI's Guideline No 03733, "Guide for selecting and specifying Materials for repair of Concrete Surfaces". These guidelines shall be followed for removal geometry, exposing and undercutting of reinforcing steel, cleaning and repair of reinforcing steel, and edge and surface condition of concrete and shall be followed regardless of the amount of corrosion present or not present in the reinforcing steel.

2. Remove unsound deteriorated concrete from Work by high pressure water blasting machines capable of scoring concrete surfaces to minimum amplitude roughness of 3/16-inch. Remove to provide for minimum thickness specified for mortar. If reinforcing is exposed in this process, then additional concrete shall be removed until the surface is a minimum of 1-inch or 1 bar diameter behind the exposed reinforcing.
3. Clean exposed reinforcing bars of rust and other deleterious materials which may prevent bonding of the repair product.
4. Keep surface at saturated surface dry (SSD) condition for a minimum of 24-hours prior to placement of repair material.
5. Place material in accordance with Manufacturer's written recommendations.
6. Cure material continuously for 7-days with water fog nozzles or other applications which provide a continuous wet curing of the repaired area in accordance with ACI 308, "Standard Practice for Curing Concrete".

### 3.3 CONSOLIDATION

- A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled.

### 3.4 REPAIRS AND PROTECTION

- A. All grout applications shall be free of any damage, deficiencies, or surficial imperfections at the time of Project completion.

**END OF SECTION**

# **DIVISION 5**

## **METALS**

## SECTION 05500

### METAL FABRICATIONS & MISCELLANEOUS METAL

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This section covers all anchor bolts, expansion anchors, items fabricated from metal shapes, plates, sheets, rods, bars, or castings and all other wrought or cast metal.

Fabricated metal items which are detailed on the Plans but not mentioned specifically shall be fabricated in accordance with the applicable requirements of this section.

##### 1.2 SHOP DRAWINGS & SUBMITTALS

- A. The Contractor shall submit detailed shop drawings for each metal fabrication showing materials, dimensions, connecting and fabrication techniques in accordance with the General Conditions. Submittals shall be furnished for all manufactured items such as anchor bolts, expansion anchors, pipe supports, and gratings in accordance with the General Conditions.

##### 1.3 REFERENCE SPECIFICATIONS

- A. All materials and work for miscellaneous metal work shall comply with applicable requirements of the AISC "Steel Construction Manual." Welded connections shall be in accordance with applicable requirements of the American Welding Society.

#### PART 2 - MATERIALS

##### 2.1 BASIC MATERIALS

- A. All materials shall be new and undamaged and shall conform to pertinent ASTM or other industry standard specifications, including the following:
- B. 

Steel	
Plates and Shapes	ASTM A36
Sheets	ASTM A366 or A569, Zinc Coated
Pipe	ASTM A120
Structural Tubing	ASTM A500 or A501
Bolts - High Strength	ASTM A325
Unfinished	ASTM A307
Nuts	ASTM A563 or A563M
Washers	ASTM F436/F436M
Anchor Rods	ASTM F1554, Grade 36, Plain
Welding Materials	AWS D1.1/D1.1M

C.	Cast Iron Castings	ASTM A48, Class 25 or better
D.	Stainless Steel Plates and Shapes Bolts & Nuts	ASTM A167 IFI-104, Grade 303 or 305
E.	Aluminum Sheet and Plate Roof Bar	ASTM B209, Alloy 6061-T1 ASTM B211, Alloy 6061-T6 or 2017-T4
F.	Extrusions Pipe  Castings	ASTM B211, Alloy 6063-T5 or T6 ASTM B429, Alloy 6061-T6 or 6063-T6 ASTM B26 or B85

## 2.2 MISCELLANEOUS FASTENERS

- A. All fasteners shall be new and undamaged and shall be furnished with washers, lock washers and all accessories appropriate for the applications. This section shall not supersede specific fastener requirements made in other sections.
- B. Anchor Bolts
- |                              |   |
|------------------------------|---|
| Galvanized Steel             | ASTM F1554, Grade 36, Plain                                       |
| Carbon Steel<br>Flat Washers | ASTM A307<br>ANSI B18.22.1, of same material as<br>bolts and nuts |
- C. Expansion Anchors  
For Concrete
- Hilti HY 200, or Equal

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Connections - All bolts shall be equipped with self-locking nuts or lock washers. Where welding is required or permitted, all butt and miter welds shall be continuous and where exposed to view shall be ground smooth. In addition, intermittent welds shall have an effective length of at least two inches and shall be spaced not more than six inches apart.
- B. Fabrication and Erection - Miscellaneous metal shall be fabricated in conformity with dimensions, arrangement, sizes and weights or thicknesses shown on the Plans or stipulated in the Specifications. All members and parts, as delivered and erected, shall be free of winds, warps, local deformations, and unauthorized bends. Holes and other provisions for field connections shall be accurate and shop checked so that proper fit will result when the units are assembled in the field. Erection drawings shall be prepared if required, and each separate piece shall be marked as indicated thereon. All field connection materials shall be furnished. Before assembly, surfaces to be in contact with each other shall be thoroughly cleaned. All parts shall be assembled accurately as shown on the Plans. Light drifting will

be permitted to draw parts together, but drifting to match unfair holes will not be permitted. Any enlargement of holes necessary to make connections in the field, shall be done by reaming with twist drills. Enlarging holes by burning is absolutely prohibited.

- C. Storage - Miscellaneous metal shall be stored on blocking so that no metal touches the ground and water cannot collect thereon. The material shall be protected against bending under its own weight or superimposed loads.
- D. Edge Grinding - Sharp corners of cut or sheared edges shall be dulled by at least one pass of a power grinder to improve paint or galvanizing adherence.
- E. Aluminum - All aluminum that will be in direct contact with concrete shall be liberally coated with bituminous material in a manner approved by the Engineer prior to being installed.

### 3.2 ANCHOR BOLTS

- A. Anchor bolts shall conform to the material requirements for bolts and nuts in this section and to the placement requirements of the Plans. All anchor bolts shall be zinc-plated steel unless otherwise specified or indicated on the Plans.

### 3.3 EXPANSION ANCHORS

- A. Expansion anchors shall be installed in conformity with the manufacturer's recommendations for maximum holding power, but in no case shall the depth of the hole be less than four bolt hole diameters. Minimum distance between the center of any expansion anchor and an edge or exterior corner of concrete shall be at least 4 1/2 times the diameter of the hole in which the anchor is installed, unless otherwise indicated on the Plans. The minimum distance between the centers of expansion anchors shall be at least eight times the diameter of the hole in which the anchors are installed.

Nuts and washers for expansion anchors shall be as specified for anchor bolts. Expansion anchors shall be zinc-plated steel unless otherwise specified or indicated on the Plans.

**END OF SECTION**

# **DIVISION 6**

## **WOOD AND PLASTICS**



## **SECTION 06100**

### **CARPENTRY**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. This section covers items required by the Plans to be of wood construction except wood doors and shall include the following:
  - 1. Framed bearing walls, partitions, floor systems and roof systems
  - 2. Miscellaneous items associated the wall, floor, and roof assemblies
  - 3. Miscellaneous trim and fasteners

##### **1.2 QUALITY ASSURANCE**

- A. The Contractor shall provide sufficient workmen and supervisors who shall be present at all times during execution of this portion of the work, and who shall be thoroughly familiar with the type of construction involved and the materials and techniques specified. The Engineer will make no allowance for lack of skill on the part of the workmen in accepting or rejecting the work.

##### **1.3 SUBMITTALS**

- A. The Contractor shall submit complete specifications, data, and catalog cuts and drawings covering all materials and items found under this section.

##### **1.4 PROTECTION AND STORAGE**

- A. Lumber and finish carpentry items shall be protected and kept under cover, both in transit and at the jobsite. Lumber shall be carefully stacked on suitable supports in a manner which will ensure proper ventilation and drainage. Finish carpentry items shall be stored in a dry, weathertight building and protected from damage or soiling by cartons or other suitable means.

#### **PART 2 - MATERIALS**

##### **2.1 LUMBER**

- A. American Standard Lumber conforming to PS 20, moisture content 19 percent or less; sized dry
- B. Structural Dressed - Southern pine or Douglas fir, S4S; structural joists and planks, No. 2 & BTR; studs, stud grade
- C. Pressure Treated - Structural lumber, pressure treated with non-watersoluble preservative in accordance with AWWA C2, except that creosote treatment will be acceptable for buried members only. Roof nailers and cants shall be treated with pentachlorophenol by the L.P. gas process. Cut surfaces shall be given two heavy brush coats of preservative.

##### **2.2 REDWOOD**

- A. Construction Grade
- 2.3 PLYWOOD OR OSB PANELS
  - A. Roof & Wall sheathing - APA rated sheathing, Exposure 1, thickness per plan.
- 2.4 GLULAMS
  - A. Materials, Manufacture and Quality Assurance
    - 1. Structural glued laminated timber of softwood species shall be in conformance with ANSI Standard A190.1, American National Standard for Structural Glued Laminated Timber, or other code-approved design, manufacturing and/or quality assurance procedures.
  - B. Trademarks
    - 1. Members shall be marked with the Engineered Wood Systems APA EWS trademark indicating conformance with the manufacturing, quality assurance and marking provisions of ANSI Standard A190.1.
- 2.5 FASCIA & EAVE TRIM
  - A. 26 Gauge galvanized steel to match roof. Color: Blue
- 2.6 WOOD TRIM (inside)
  - A. 1 X White Pine
- 2.7 BASEBOARD TRIM
  - A. 4" Vinyl cove base except Restroom Areas which are to be 6" high Vinyl cove base.
- 2.8 FASTENERS
  - A. Nails - Galvanized or aluminum coated
  - B. Bolts & Nut - ASTM A307, galvanized ASTM A153, cadmium-plated ASTM A165 Type NS or zinc-plated ASTM A164 Type GS
  - C. Wood Screws - 18-8 stainless steel
  - D. Gypsum Board Fasteners - Bugle head screws 1 5/8"
- 2.9 OTHER MATERIALS
  - A. Polyethylene Film - Fed Spec L-P-378, Type I, 6 mil
- 2.10 ROOF VENTS

- A. Spun aluminum 16" gravity relief ventilator with curb and flashing to fit standing seam metal roof system. Unit shall be model PR as manufactured by Loren Cook Company or equal.

## 2.11 TRUSSES

- A. Lumber:
  - 1. Lumber used shall be identified by grade mark of a lumber inspection bureau or agency approved by the American Lumber Standards Committee, and shall be the size, species, and grade as shown on the Truss Design Drawings, or equal as approved by the Truss Design Engineer/ Truss Designer.
  - 2. Adjustment of value for duration of load or conditions of use shall be in accordance with NDS.
  - 3. Fire retardant treated lumber, if applicable, shall meet the specifications of the fire retardant chemical manufacturer, the Truss design and the Standard and shall be re-dried after treatment in accordance with the American Wood-Preservers' Association (AWPA) Standard C20 Structural Lumber – Fire Retardant Treatment by Pressure Processes. Allowable values must be adjusted in accordance with NDS. Lumber treater shall supply certificate of compliance.
- B. Metal Connector Plates:
  - 1. Metal connector plates shall be manufactured by a Truss Plate Institute (TPI) member plate manufacturer and shall not be less than 0.036 in. thick (20 gauge) and shall meet or exceed ASTM A653/A653M grade 33, and galvanized coating shall meet or exceed ASTM A924/924M, coating designation G60. Working stresses in steel are to be applied to effectiveness ratios for plates as determined by test and in accordance with the Standard.
  - 2. In highly corrosive environments, special applied coatings or stainless steel may be required.
  - 3. At the request of the Building Designer, a TPI member plate manufacturer shall furnish a certified record that materials comply with steel specifications.

## 2.12 VAPOR BARRIER

- A. 10 mil polyethylene

## 2.13 WEATHER BARRIER

- A. "Tyvek" or equal;
- B. Other materials necessary for the completion of the work shall conform to the requirements of other sections of these Specifications or conform to industry standards for the type of material and use thereof.

## 2.14 CASEWORK

- A. AWI Custom Grade
- B. Exposed Exterior/Interior Surfaces: High Pressure Decorative Laminate

- C. Semi-Exposed Surfaces: Thermoset Decorative Panels
- D. Casework Construction Type: Type A – Frameless
- E. Cabinet and Door Style: Flush Overlay
- F. Shelving: ¾” thick typical. Shelving wider than 24” shall be 1” thick.
- G. Drawer Side Construction: Glued dovetail joints
- H. Countertops: Medium density fiberboard substrate covered with HPDL, conventionally fabricated and self-edge banded.
- I. Hardware:
  - 1. Adj. shelf supports: BHMA A156.9
  - 2. Drawer and Door Pulls: 4” “U” shaped wire pull, steel with satin finish
  - 3. Drawer Slides: Full extension, BHMA 156.9, Grade 1HD-100 and 200, side mount, ball bearing slides.
  - 4. Hinges: BHMA A156.9, B01602, 135 degree, European style

## 2.15 MATERIAL QUALITY

- A. The Contractor shall provide quality materials for the work. All lumber with excessive warp, twist, bow, or other defects; all plywood with excessive blows, voids, delaminations or other defects; and other substandard products will be rejected whether or not they have been installed.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. All carpentry work shall be constructed square, plumb, straight and in general conformance with the Plans. The Contractor shall notify the Engineer of any necessary adjustments or modifications necessary to join, fit or assemble the work as required prior to performing the work.

### 3.2 ROUGH CARPENTRY

- A. The Contractor shall perform all framing operations normal to the fabrication and erection indicated on the Plans and shall install all backing or bracing necessary to accommodate or support utilities, accessories or other items of work.
- B. All horizontal members shall be set with the crown up. Horizontal beams or joists shall not be notched, bored or cut for utilities, ducts or conduits, except as approved by the Engineer.
- C. All bearings and beam seats shall be finished to provide full bearing and even support to the structural member.

- D. Bridging consisting of two-inch by three-inch nominal wood cross bracing, metal bridging of equal strength, or solid blocking shall be installed between joists where the span exceeds eight feet.
- E. Structural lumber in exterior locations; lumber in contact with concrete, masonry, earth or water; and all wood nailers shall be pressure treated unless otherwise specified.
- F. Structural dressed lumber blocking shall be provided between studs in gypsum wallboard partitions at toilet partitions, toilet accessories, wall-type door bumpers, and other similar locations. Blocking required shall be sufficient to securely anchor each item.
- G. Wood purlins shall be centered and straight and of sufficient length to cover no less than three supports.
- H. Partitions and stud walls shall have single-length studs with a treated bottom plate and double interlocking top plates. Cross bracing shall be provided at corners and across hallways of walls otherwise unsupported at the top. Corners shall be framed with three or more studs to provide bearing for wall finish.
- I. Full-height walls shall be framed to extend to the roof diaphragm. An airtight seal shall be provided at the diaphragm between the framing member or plate and the metal roof deck using caulking or deck foam closures as required.

### 3.3 FINISH CARPENTRY

- A. The Contractor shall use qualified finish craftsmen for all finish carpentry work. Only qualified materials will be accepted. All rejected materials shall be removed from the site immediately.
- B. Finish carpentry items and millwork shall be shop made and assembled, and shall be delivered to the jobsite in a clean, undamaged condition. Workmanship in connection with finished carpentry shall conform to the best standards of the trade and shall be acceptable to the Engineer. Woodwork shall have a fine, smooth finish and shall be free from machine or tool marks, abrasions, raised grain, or knots on exposed surfaces.
- C. Finish woodwork shall be installed plumb and level, straight and true, but shall not be installed until the areas are enclosed and dry. Woodwork shall be fitted and scribed to other finished work with tight, straight joints. Woodwork shall be blind-nailed wherever possible, but where not possible, the nailing shall be located, driven, and putty filled so as to be inconspicuous.
- D. Finish woodwork shall be cleaned and sanded parallel to the grain prior to finishing as covered in the painting section. All prefinished work shall be inspected and touched up as required.

### 3.4 FASTENING

- A. The Contractor shall provide fasteners properly selected for the material to be fastened and the substrate to which the material will be attached, designed to develop the proper and adequate strength commensurate with the use.

- B. Nails shall be common or box, conforming to the above paragraph. All nailing shall be done without splitting the wood. Pre-bored holes shall be used as required. All split wood shall be replaced.
- C. Bolts shall be installed in holes bored straight and true from one side only. Holes shall be 1/16 inch larger than the bolt. Washers shall be used on the head of the nut where bearing is against a wood surface.
- D. Screws and lag bolts shall be screwed into pre-bored holes the same size as the root of the thread with an enlarged hole for the shank. Wood screws shall be countersunk and puttied over. Lag screws shall be made up tight without stripping. Pounded screws will be rejected.
- E. All other fastening shall be as per the International Building Code unless otherwise indicated on the Drawings.
- F. Backing shall be provided at all mitered fascia joints. Joist hangers and rafter connectors shall be utilized at all plate connections.

### 3.5 TRUSSES

- A. Trusses shall be factory-built and shall require a licensed engineer's stamp of approval for the design for the truss. The truss shall be designed for the following loads conditions:
  - 1. Snow load 50 psf
  - 2. Wind load 90 mph, 3 Second Gusts
  - 3. Seismic Design Category Per Montana Building Codes

Note: Montana Building Code requirements for snow load, wind load, and seismic design shall govern. The contractor / truss supplier shall verify requirements for project location.
- B. Appropriate point loads shall be taken into account during truss design.
- C. Trusses shall be of the open web type to allow for installation of duct work. Truss depth shall be sufficient to allow for required insulation "R" - values as indicated on the drawings.
- D. Care shall be taken in truss assembly and placement to prevent splitting and cracking of the truss members. Defective assemblies will be rejected whether or not they have been installed. Trusses shall be fastened to the top plate using H-1 Simpson Hurricane clips plus 2-16d nails.
- E. Any framing plan differing from those shown on the Drawings shall be submitted to the Engineer for approval prior to construction.
- F. Trusses shall be handled during manufacturing, delivery and by the Contractor at the job site so as not to be subjected to excessive bending.
- G. Trusses shall be unloaded in a manner so as to minimize lateral strain. Trusses shall be protected from damage that might result from on-site activities and environmental conditions. Trusses shall be handled in such a way so as to prevent toppling when banding is removed.

- H. Contractor shall be responsible for the handling, installation, and temporary restraint/bracing of the Trusses in a good workmanlike manner and in accordance with the recommendations set forth in the latest edition of *BCSI*.
- I. Apparent damage to Trusses, if any, shall be reported to Truss Manufacturer prior to erection.
- J. Trusses shall be set and secured level and plumb, and in correct location. Each Truss shall be held in correct alignment until specified permanent restraint and bracing is installed.
- K. Cutting and altering of Trusses is not permitted. If any Truss should become broken, damaged, or altered, written concurrence and approval by a Registered Design Professional is required.
- L. Concentrated loads shall not be placed on top of Trusses until all specified restraint and bracing has been installed and decking is permanently nailed in place. Specifically avoid stacking full bundles of plywood or other concentrated loads on top of Trusses.
- M. Truss Submittals and any supplementary information provided by the Truss Manufacturer shall be provided by the Contractor to the individual or organization responsible for the installation of the Trusses.
- N. Trusses shall be permanently restrained and braced in a manner consistent with good building practices as outlined in *BCSI* and in accordance with the requirements of the Construction Documents. Trusses shall furthermore be anchored or restrained to prevent out-of-plane movement so as to keep all Truss members from simultaneously buckling together in the same direction. Such permanent lateral restraint shall be accomplished by: (a) anchorage to solid end walls; (b) permanent diagonal bracing in the plane of the web members; or (c) other suitable means.
- O. Materials used in temporary and permanent restraint and bracing shall be furnished by Contractor.

**END OF SECTION**

# **DIVISION 7**

## **THERMAL AND MOISTURE PROTECTION**



## **SECTION 07111**

### **BITUMINOUS DAMPPROOFING**

#### **PART 1 - GENERAL**

##### **1.1 SECTION INCLUDES**

- A. Bituminous dampproofing.

##### **1.2 REFERENCE STANDARDS**

- A. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2018).
- B. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.
- C. NRCA (WM) - The NRCA Waterproofing Manual; 2005.

##### **1.3 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this section with at least three (3) years of documented experience.

##### **1.4 FIELD CONDITIONS**

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application until dampproofing has cured.

#### **PART 2 - PRODUCTS**

##### **2.1 MANUFACTURERS**

- A. Bituminous Dampproofing Manufacturers:
  - 1. Karnak Corporation
  - 2. Mar-Flex Systems, Inc
  - 3. W. R. Meadows, Inc
  - 4. Or Equal

## 2.2 BITUMINOUS DAMPPROOFING

- A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
  - 1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
  - 2. Composition - Horizontal and Low-Slope Application: ASTM D1227 Type II or III.
  - 3. VOC Content: Not more than permitted by local, State, and federal regulations.
  - 4. Applied Thickness: 1/16 inch, minimum, wet film.
- B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions are acceptable prior to starting this work.
- B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

### 3.2 PREPARATION

- A. Protect adjacent surfaces not designated to receive dampproofing.
- B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.
- C. Do not apply dampproofing to surfaces unacceptable to manufacturer.
- D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

### 3.3 APPLICATION

- A. Foundation Walls: Apply two coats of asphalt dampproofing.
- B. Foundation Walls: Patch disturbed areas of existing dampproofing with two additional coats of dampproofing of the same generic type.
- C. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

- D. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.
- E. Apply bitumen with mop.
- F. Seal items watertight with mastic, that project through dampproofing surface.
- G. Immediately backfill against dampproofing to protect from damage.

**END OF SECTION**

**SECTION 07210**  
**BUILDING INSULATION**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Batt and Roll Insulation.
- B. Blown Insulation.
- C. Board Insulation.
- D. Blanket Insulation.

1.2 REFERENCES

- A. ASTM C 764 - Standard. Specification for Mineral Fiber. Loose-Fill Thermal Insulation.
- B. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. ASTM E 96 - Standard Test Methods for Water Vapor Transmission of Materials.
- D. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- E. National Fire Protection Association (NFPA) Life Safety Code
- F. ASTM C 518 – Standard for thermal performance
- G. Federal Specification HH-I-521F – Insulation blankets, thermal (mineral fiber, for ambient temperatures).

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300 - Administrative Requirements.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.
- B. Installer Qualifications: Products listed in this section shall be installed by a single organization with at least five years experience successfully installing insulation on projects of similar type and scope as specified in this section.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.
- B. Storage: Store materials in dry locations with adequate ventilation, free from water, and in such a manner to permit easy access for inspection and handling.
- C. Handling: Handle materials to avoid damage.

#### 1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: CertainTeed Corp., Dow Chemical Company, Owens-Corning, or equal.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600 - Product Requirements.

#### 2.2 BATT AND ROLL INSULATION

- A. Vapor Retarder
  - 1. Under Slab: 10 mil polyethylene
  - 2. Under Gypsum Board: 6 mil polyethylene
  - 3. Exposed and Semi-exposed Location: Foil-Scrim-Kraft type
- B. Thermal Batt Insulation: CertainTeed Fiber Glass Building Insulation, or equal. Fiber glass building insulation for walls, ceilings, attics and floors. Complies with ASTM C 665; preformed glass fiber batt insulation:
  - 1. Facing: ASTM C 665 Type I Unfaced.
    - a. Fire Hazard Classification: ASTM E 84:

- 1) Maximum Flame Spread Index; 25.
- 2) Maximum Smoke Developed Index; 50.
- b. Non-combustibility: ASTM E 136, passes.
- c. Thermal Resistance: R of 13.
  - 1) Thickness: 3-1/2 inches.
- d. Thermal Resistance: R of 21.
  - 1) Thickness: 5-1/2 inches.
- e. Thermal Resistance: R of 38.
  - 1) Thickness: 12 inches

## 2.3 BLOWN INSULATION

- A. Thermal Blown Insulation: Certaineed Insulsafe SP Fiber Glass Blowing Insulation, or equal. Fiber glass blowing insulation for open attics, enclosed walls, and floor/ceilings assemblies. Complies with ASTM C 764; mineral fiber loose fill insulation Type 1, Pneumatic application:
  - 1. Fire Hazard Classification: ASTM E 84:
    - a. Maximum Flame Spread Index; 5.
    - b. Maximum Smoke Developed Index; 5.
  - 2. Noncombustibility: ASTM E 136, passes.
  - 3. Open Attic Application:
    - a. Thermal Resistance: R of 49. Minimum Installed Thickness: 18.50 inches.
    - b. Thermal Resistance: R of 38. Minimum Installed Thickness: 14.50 inches.
    - c. Thermal Resistance: R of 30. Minimum Installed Thickness: 11.75 inches.

## 2.4 BOARD INSULATION

- A. Rigid Insulation for Foundations
  - 1. Rigid closed-cell extruded polystyrene foam insulation.
    - a. Comply with ASTM C 578-92, Type VI, density 1.8 lb/cu. ft. min., compressive strength 40 psi (ASTM D 1621-73).
    - b. Thermal resistance: 5-year aged R-values of 5.4 and 5.0 min., oF-ft<sup>2</sup>-h/Btu<sup>2</sup>/inch at 40oF and 75oF respectively (ASTM C 518-91).
    - c. Thickness: 2" unless otherwise indicated.
    - d. Acceptable manufacturer's product: The Dow Chemical Company STYROFOAM™ Brand Highload 40 Extruded Polystyrene Foam Insulation, or equal.
- B. Rigid Foam Board Building Insulation
  - 1. Polyisocyanurate foam rigid board insulation.
    - a. Comply with ASTM C1289, Type I, Class 2, Fed. Spec. HH-I-1972/1, Class 2.
    - b. compressive strength 25 psi (ASTM D 1621).
    - c. Thermal resistance: R-6.5 per 1 inch thickness (ASTM C 518@75°F), (ASTM C 1363@75°F).
    - d. Density (ASTM) D1622) Nominal 2.0 pcf.

- e. Thickness: 2" unless otherwise indicated.
- f. Board edges: Shiplapped
- g. Joints: Use joint closure strips or joint tape as recommended by the manufacturer.
- h. Facing: 1.0 mil thick aluminum foil facer, both sides
- i. Foam surface burning characteristics: Flame spread < 25, Smoke developed <450.
- j. Water vapor transmission (ASTM E96): < 0.03 perms.
- k. Water absorption by volume (ASTM C209): Max. 0.3 percent.
- l. Acceptable manufacturer's product: The Dow Chemical Company, THERMAX Insulation Sheathing, or equal.

## 2.5 BLANKET INSULATION

- A. Blanket Insulation, Certainteed Commercial Blanket Insulation, or equal. Complies with ASTM C 553, Type I and ASTM 665, Type I Plain. Composed of inorganic glass fibers bonded with a thermoset resin.
  - 1. Fire Hazard Classification: ASTM E 84:
    - a. Maximum Flame Spread Index; 25.
    - b. Maximum Smoke Developed Index; 50.
  - 2. Noncombustibility: ASTM E 136.
  - 3. Size:
    - a. Thickness: As indicated on the plans.
- B. Metal Building Insulation, Certainteed Metal Building Insulation, or equal. Complies with ASTM C 553, Type I and ASTM 665, Type I Plain. Composed of inorganic glass fibers bonded with a thermoset resin.
  - 1. Fire Hazard Classification: ASTM E 84:
    - a. Maximum Flame Spread Index; 25.
    - b. Maximum Smoke Developed Index; 50.
  - 2. Size:
    - a. Thickness: as indicated on the plans
  - 3. Vapor Retarder:
    - a. Type: as indicated on the plans
  - 4. Metal Building Insulating System
    - a. "Simple Saver System" where indicated on the plans.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. Verify that all exterior and interior wall, partition, and floor/ceiling assembly construction has been completed to the point where the insulation may correctly be installed.

- C. Verify that mechanical and electrical services in ceilings, walls and floors have been installed and tested and, if appropriate, verify that adjacent materials are dry and ready to receive insulation.
- D. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

### 3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install specific type and thickness (R-Value) insulation product as indicated on the drawings.
- C. Install in exterior spaces without gaps or voids. Do not compress insulation.
- D. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- E. Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within plane of insulation.
- F. Install insulation with vapor barrier installed facing the warm side. Seal or tape joints as required.

### 3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

## **END OF SECTION**



## **SECTION 07411**

### **METAL SIDING**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. This section includes metal siding and accessories for the new HHW Building and Attendant Building.
- B. Metal siding shall match the siding approved for installation on the WTB Building which is part of Section 13120 Metal Building Systems.

##### **1.2 SHOP DRAWINGS**

- A. The following Shop Drawings shall be submitted in accordance with the General Conditions:
- B. Shop drawings shall be submitted indicating the siding panel layout, profile dimensions, supports, projections, openings, reinforcements, finishes, pertinent details, and accessories. Color chips of available colors shall be submitted for approval.

#### **PART 2 - MATERIALS**

##### **2.1 MATERIALS**

- A. Sheet Steel Sheet steel shall meet the requirements of ASTM A446, Grade E, minimum tensile strength of 50,000 psi and minimum yield strength of 50,000 psi. or as approved for installation on metal building systems for this project.
- B. Finish The paint system shall consist of a galvanized coating on the base high tensile steel. The steel shall then be cleaned and etched for proper adhesion of the primer coat. A thermo-setting primer coat shall be applied and then sent into a curing oven. A final coat of 1 mil thermo-setting polyester paint shall be applied and placed in an oven for final curing.

- 1. Color: Medium Grey Siding with Blue trim

##### **2.2 FABRICATION**

- A. Metal Siding Metal siding shall be ribbed panels with a minimum 24 gauge. Sheets shall have a 36-inch covering with multiple span and lapped joints. Panels shall be factory pre-punched and cut to the appropriate length.
- B. Accessories Corner caps, starter strips, door and window trim, head flashing, foam cell closures, etc. shall be as recommended by the manufacturer to match siding material and finish.

## 2.3 FASTENERS

- A. General Fastening shall be as per manufacturer's recommendations. At a minimum the Contractor shall use self- tapping, corrosion-resistant polymer-coated steel screw fasteners with metal and neoprene sealing washers. Wall fasteners shall be painted or capped to match the wall color.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Metal siding shall be erected in accordance with the SDI Design Manual and shall be installed by qualified workmen experienced in this sort of work. Before starting work, governing dimensions shall be verified.
- B. On wood support members, 1-1/2" minimum bearing shall be provided. Wood support members shall be aligned and leveled on the supports.
- C. Male/female side laps shall be mechanically fastened at a maximum spacing of 24 inches O.C. or as per manufacturer's recommendations. All joints shall be snug and lines shall be true and plumb. Sealants for side laps, end laps, and flashing shall be 0.006" thick butyl tape installed uniformly to prevent moisture penetration.
- D. Trim for corners, openings, etc. shall be furnished and installed in accordance with the manufacturer's recommendations.
- E. Foam cell closures shall be installed at the roofing perimeter and top and bottom of wall panels.
- F. All welds shall be cleaned of spatter and flux, wire brushed, and coated as required in the painting section.

**END OF SECTION**

**SECTION 07412**  
**METAL ROOFING**

**PART 1 - GENERAL**

1.1 DESCRIPTION

- A. This section includes metal roofing and accessories for the new HHW Building and the Attendant Building
- B. Metal roofing shall match the roofing approved for installation on the WTB Building which is part of Section 13120 Metal Building Systems.

1.2 SHOP DRAWINGS

- A. The following Shop Drawings shall be submitted in accordance with the General Conditions:
- B. Shop drawings shall be submitted indicating the roofing and decking plans, profile dimensions, supports, projections, openings, reinforcements, finishes, pertinent details, and accessories. Color chips of available colors shall be submitted for approval.

**PART 2 - MATERIALS**

2.1 MATERIALS

- A. Sheet Steel
  - 1. Sheet steel shall meet the requirements of ASTM A446, Grade E, minimum tensile strength of 50,000 psi and minimum yield strength of 50,000 psi.
- B. Finish
  - 1. The paint system shall consist of a galvanized coating on the base high tensile steel. The steel shall then be cleaned and etched for proper adhesion of the primer coat. A thermo-setting primer coat shall be applied and then sent into a curing oven. A final coat of 1 mil thermo-setting polyester paint shall be applied and placed in an oven for final curing. Color shall be as shown on the plans or as approved by the Engineer.
    - a. Color: Dark Grey

2.2 FABRICATION

- A. Metal Panels
  - 1. Metal roofing and fascia panels shall be 24 gauge pre-painted galvanized steel. Panels shall match and shall be supplied by the same manufacturer. Panels shall be 2" deep minimum and shall be vertical leg standing seam. Profile as manufactured by MBCI Metal Roof and Wall Systems, or equal; Batten Lok; 12" wide; with U.L. 90 mph wind uplift rating or approved equal. Panels shall have concealed fasteners and be capable of transitioning smoothing from roof to fascia.

B. Accessories

1. Corner caps, starter strips, flashing, ridge caps, foam cell closures, etc. shall be as recommended by the manufacturer to match roofing material and finish.

2.3 FASTENERS

A. General

1. Concealed fastening system shall be as per manufacturer's recommendations. Any exposed fasteners for trim items shall be self-tapping, corrosion-resistant polymer-coated steel screw fasteners with metal and neoprene sealing washers. Wall fasteners shall be painted or capped to match the roof color.

**PART 3 - EXECUTION**

3.1 INSTALLATION

- A. Metal roofing shall be erected in accordance with the SDI Design Manual for Roof Decks and shall be installed by qualified workmen experienced in this sort of work. Before starting work, governing dimensions shall be verified.
- B. On wood support members, 1-1/2" minimum bearing shall be provided. Wood support members shall be aligned and leveled on the supports.
- C. Male/female side laps shall be mechanically fastened at a maximum spacing of 24 inches O.C. or as per manufacturer's recommendations. All joints shall be snug and lines shall be true and plumb.
- D. Trim for corners, the ridge, openings, etc. shall be furnished and installed in accordance with the manufacturer's recommendations.
- E. Foam cell closures shall be installed at the eaves, ridge, and other areas that work otherwise be open to the weather.
- F. All welds shall be cleaned of spatter and flux, wire brushed, and coated as required in the painting section.

**END OF SECTION**

## SECTION 07920

### SEALANTS & CAULKING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. This section covers all caulking and sealing of joints as required to provide a positive barrier against passage of air and/or moisture.

##### 1.2 SUBMITTALS

- A. Manufacturers' data for all sealants must be submitted to the Engineer before their use in the work.

#### PART 2 - MATERIALS

##### 2.1 SEALANTS

- A. Two component sealants shall be rubber-based compound. Each color and class of sealants shall be the product of a single manufacturer selected from the following, or shall be equal products as approved in advance by the Engineer:
  - 1. Class "A" (for non-traffic bearing horizontal surfaces). SEALANTS shall be "Sikaflex 2C SL" by Sika Corporation; "Paramastic" as manufactured by Parr, Inc., or equal.
  - 2. Class "B" (for vertical surfaces). SEALANTS shall be "Sikaflex 2C NS" by Sika Corporation; or equal.
- B. Single components sealants shall be silicone-based. Each color and class of sealant shall be the product of a single manufacturer selected from the following, or shall be equal products approved in advance by the Engineer:
  - 1. Interior Wet or Moist Locations (restrooms, locker rooms, break rooms, etc.) Sealants shall be: Dow Corning 786 Mildew Resistant Silicone Sealant; G.E. Silicone II Kitchen and Bath sealant; or equal.
  - 2. Interior/Exterior General Waterproofing and sealing (Door and window frames, metal panels, etc.)
  - 3. Sealants shall be: Dow Corning 791 Silicone Perimeter Sealant; G.E. Silicone II Sealant or equal.
- C. Colors for each sealant installation shall be approved by the Engineer from standard colors normally available from the specified manufacturers. If the standard color approved by the Engineer is not available from the approved manufacturer except at additional charge, the Contractor shall provide the approved color at no additional cost to the Owner.

In concealed installations and in partially or fully exposed installations where approved by the Engineer, standard gray or black sealants may be used.

## 2.2 PRIMERS

- A. The Contractor shall use only those primers that are non-staining, have been tested for durability on the surfaces to be sealed, and are specifically recommended for this installation by the manufacturer of the sealants used.

## 2.3 BACKUP MATERIALS

- A. Only those backup materials which are specifically recommended for this installation by the manufacturer of the sealants used and which are nonabsorbent and non-staining shall be used by the Contractor.

Acceptable types of backup materials include:

1. Closed-cell resilient urethane or polyvinyl-chloride foam;
2. Closed-cell polyethylene foam;
3. Closed-cell sponge of vinyl or rubber;
4. Polychloroprene tubes or beads;
5. Polyisobutylene extrusions; or
6. Oil-less dry jute.

Preformed support strips for ceramic tile control-joint and expansion-joint work shall be polyisobutylene or polychloroprene rubber.

## 2.4 BOND-PREVENTIVE MATERIALS

- A. The Contractor shall use one of the following bond-preventing materials. The particular material used shall be the one best suited for the application as recommended by the manufacturer of the sealants used.
  1. Polyethylene tape, pressure-sensitive adhesive, with the adhesive required only to hold tape to the construction materials as indicated;
  2. Aluminum foil; or
  3. Wax paper.

## 2.5 MASKING TAPE

- A. The Contractor shall provide a masking tape for masking around joints.

## 2.6 OTHER MATERIALS

- A. All other materials not specifically described but required for complete and proper caulking and installation of sealants shall be first quality of their respective kinds, new, and subject to the approval of the Engineer.

## **PART 3 - EXECUTION**

### **3.1 INSPECTION**

- A. The Contractor shall examine the areas and conditions under which the work covered by this section will be performed. Conditions which may be detrimental to the proper and timely completion of the work shall be corrected by the Contractor. The Contractor shall not proceed with the work until such detrimental conditions have been corrected.

### **3.2 PREPARATION**

- A. Concrete surfaces. All concrete surfaces in contact with sealants shall be dry, sound and well brushed and wiped free from dust. Solvent shall be used to remove oil and grease, and the surface shall then be wiped with clean rags. Where surfaces have been treated, the surface treatment shall be removed by means of sandblasting or wire brushing. All laitance and mortar from joint cavities shall also be removed. Where a backstop is required, the approved backup material shall be inserted into the joint cavity to the depth required.
- B. Steel surfaces. Steel surfaces in contact with sealants shall be sandblasted. If sandblasting would not be practical or would damage adjacent finishes, the metal shall instead be scraped or wire-brushed to remove mill scale. Solvent shall be used to remove oil and grease, and the surface shall then be wiped with clean rags. Protective coatings on steel shall be removed by sandblasting or by a solvent that leaves no residue.

### **3.3 INSTALLATION OF BACKUP MATERIAL**

- A. The Contractor shall use only the backup materials recommended by the manufacturer of the sealants and approved by the Engineer for the particular installation. The backup material shall be compressed 25 to 50 percent to provide a positive and secure fit. When using backup material of tube or rod stock, the Contractor shall avoid lengthwise stretching of the material. Hose or rod backup stock shall not be twisted or braided.

### **3.4 PRIMING**

- A. The Contractor shall use only the primer recommended by the manufacturer of the sealants and approved by the Engineer for the particular installation. The primer shall be applied in strict accordance with the manufacturer's recommendations, as approved by the Engineer.

### **3.5 BOND-BREAKER INSTALLATION**

- A. The Contractor shall install an approved bond-breaker where recommended by the manufacturer of the sealants and where directed by the Engineer. The material shall be installed in strict accordance to the manufacturer's recommendations, as approved by the Engineer.

### 3.6 INSTALLATION OF SEALANTS

- A. General. Before beginning to install sealants in each joint, the Contractor shall verify the joint type according to the details on the Plans, and shall verify that the required proportion of width of joint to depth of joint has been secured.
- B. Equipment. Sealants shall be applied under pressure with a hand- or power-actuated gun or other appropriate means. Guns shall have a nozzle of appropriate size and shall provide sufficient pressure to completely fill the joints as designed.
- C. Masking. The Contractor shall thoroughly and completely mask all joints where the appearance of sealants on adjacent surfaces would be objectionable.
- D. Installation of sealants. The sealants shall be installed in strict accordance with the manufacturer's recommendations. All joints shall be thoroughly filled to the recommended depth.
- E. Tooling. The Contractor shall tool all joints to the profile shown on the details in the Drawings.
- F. Cleanup. The Contractor shall remove all masking tape immediately after the joints have been tooled. Adjacent surfaces shall be cleaned of sealants as the installation progresses. The Contractor shall use a solvent or cleaning agent as recommended by the sealant's manufacturer for this purpose.

**END OF SECTION**



# **DIVISION 8**

## **DOORS AND WINDOWS**

## **SECTION 08110**

### **STEEL DOORS**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. This section covers hollow metal doors and frames. All doors shall be insulated steel, full flush-type doors except as otherwise shown or specified.

##### **1.2 WORKMANSHIP**

- A. The finished work shall be strong and rigid, neat in appearance, and free from defects. Molded members shall be fabricated straight and true with corner joints well formed, and with fastenings concealed where practicable.

##### **1.3 SUBMITTALS**

- A. The Contractor shall submit complete detail drawings of each door type showing elevations, frame details, identification, typical and special construction details, methods of assembly, hardware requirements, material characteristics, joints, connections and finish, all in accordance with the General Requirements.

#### **PART 2 - MATERIALS**

##### **2.1 DOOR MATERIALS**

- A. Door materials shall meet the following requirements:
  - 1. Doors & Frame: Stretcher leveled quality sheet steel with smooth, clean surface.
  - 2. Internal Reinforcing: Cold rolled steel.
  - 3. Fillers for Internally Reinforced Doors: Mineral wool, fiberglass, urethane or polystyrene foam. Exterior Doors to be thermally insulated.
  - 4. Anchoring Devices: Cadmium plated where exposed; cadmium plated or galvanized where concealed.
    - a. Expansion Anchors: Fed. Spec. FF-S-325; wedge type, Group II, Type 4, Class 1 or 2; self-drilling type, Group III, Type 1; or non- drilling type, Group VIII, Type 1 or 2; Phillips, Rawplug, USM, or equal.

##### **2.2 FRAMES**

- A. Door frames shall be formed of steel to the sizes and shapes required. Metal for door frames shall not be lighter than 14 gauge, except 16-gauge frames may be used if jambs are grouted full height. Joints in frames shall be mitered and butted, and shall be continuously welded on the reverse side to produce rigid joints that are invisible on the face of the frame. Frame bottoms shall be held rigidly in position by spreader bars to maintain proper alignment during shipment and erection.

- B. Hardware Provisions. Frames shall be prepared at the factory for the specified hardware. Frames shall be mortised, reinforced, drilled and tapped for mortised hardware, and shall be reinforced for surface-applied hardware. Cover boxes shall be provided in back of all hardware cutouts. Frames for all doors except weather-stripped doors shall be punched to receive silencers, three holes on the lock side of single door frames and one hole for each leaf in heads of double door frames. Lock strikes shall be set out and adjusted to provide clearance for silencers.

Concealed metal reinforcements shall be provided for hardware with the following minimum thicknesses:

- |    |                      |          |
|----|----------------------|----------|
| 1. | Hinge reinforcement  | 10 gauge |
| 2. | Strike reinforcement | 14 gauge |
| 3. | Closer reinforcement | 12 gauge |
| 4. | Other reinforcement  | 14 gauge |

- C. Wall & Floor Anchors. Metal anchors of the sizes and shapes required for the adjoining type of wall construction shall be provided. Jamb anchors shall be fabricated from steel, with thickness not less than the gauge used for frames. Anchors shall be located near the top and bottom of each frame and at intermediate points not to exceed 32 inches spacing.

Door frames shall be anchored to the floor with a 16-gauge base clip at each jamb. Clips shall be sized and drilled for at least two 3/8-inch anchoring devices.

## 2.3 HOLLOW METAL DOORS

- A. Doors indicated on the Plans as flush hollow metal, including doors with glazed openings, shall be as specified herein unless otherwise indicated on the plans. Doors shall be prepared to receive the hardware specified in the finish hardware section.
- B. Sizes & Clearances. Doors shall be 1-3/4 inches thick, of the sizes and design indicated on the plans. Clearances for doors, except fire doors, shall be 1/8 inch at jambs and heads, 1/4 at meeting stiles of pairs of doors, and 3/4 inch at bottom, unless otherwise indicated or specified. Clearances for fire doors shall be as required by NFPA Pamphlet #80, or by the authority having jurisdiction.
- C. Construction. Doors shall have 18-gauge seamless outer sheets except as noted on plans. Side edges of doors shall be flush and closed watertight, with all seams either mechanically interlocked, continuously welded, or spot welded at four-inch centers maximum, filled with filler metal, and dressed smooth. Doors shall be prepared at the factory for hardware and for glazing and louvers as indicated on the Plans and as specified. Door edges shall be beveled or rounded.

Internally reinforced doors shall have fillers placed in the spaces between reinforcing members and shall be reinforced by one of the following methods:

1. With interlocking vertical channels or z-shaped members, not less than 20 gauge, at six-inch spacing and welded to outer face sheets; or
2. A continuous truss of 28-gauge sheet metal welded to outer face sheets.

Foam-filled doors shall have all internal spaces completely filled with a rigid urethane core foamed in place and chemically bonded to the interior surfaces of the doors.

Out swinging exterior doors shall be finished flush at the top, with all seams and joints closed watertight as specified for side edges.

D. Hardware Provisions. Doors shall be mortised, reinforced, drilled and tapped for mortised hardware. Reinforcing units shall be provided for locksets. Reinforcing plates shall be provided for mortised and surface-applied hardware in at least the following thicknesses:

- |    |   |          |
|----|---|----------|
| 1. | Hinge reinforcement                         | 10 gauge |
| 2. | Surface-applied closers<br>& hold open arms | 12 gauge |
| 3. | Other reinforcement                         | 14 gauge |

The location of hardware items shall be in accordance with DHI "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames".

## 2.4 FINISH

A. A primer shall be applied to all surfaces of ferrous metal furnished under this section. Metal surfaces shall be cleaned and given phosphate or equivalent treatment to assure maximum corrosion protection and paint adherence. A dip or spray coat of synthetic resin, rust inhibitive, metallic oxide or zinc chromate primer shall be applied to all surfaces, then baked or oven- dried. Finished surfaces shall be smooth and free from irregularities.

## 2.5 GENERAL

A. Doors, frames and appurtenances shall be furnished and installed as specified herein and in accordance with the details and arrangements indicated on the Plans.

Subject to the specified requirements doors and accompanying frames shall be equivalent to those manufactured by:

1. Curries Manufacturing Company
2. Firedoor Corporation of America
3. Pioneer Industries
4. Trussbilt, Incorporated
5. Ceco Corporation
6. Or equal

Subject to the specified requirements, doors with foamed-in-place urethane core and accompanying frames shall be equivalent to those manufactured by:

1. The Ceco Corporation
2. Mesker Brothers Industries, Incorporated
3. Or equal

Fire doors and frames shall be provided at the locations indicated on the drawings. For doors exceeding the Underwriters' Laboratories size limitations for labeling, the UL "Certificate for Oversize Construction" shall be provided. Authorized construction details and requirements for labeling shall take precedence over the Specifications, except when thicker gauges of metal are required by these Specifications.

Doors and frames by other manufacturers may also be acceptable, provided the functional and quality requirements of this section are satisfied.

## 2.6 STEEL DOOR SCHEDULE

- A. See door schedule shown on the drawings.

## PART 3 - EXECUTION

### A. FRAMES

- B. General - All miters and joints shall form flush, hairline joints, utilizing concealed fastenings where practicable. Where the use of exposed screws, bolts or rivets cannot be avoided, heads shall be countersunk and finished to match adjacent work.

Frames for doors shall be of sizes indicated and proper depth to fit the full thickness of the wall. Door stops shall be the manufacturer's standard stops with integral weather-stripping at head and jambs.

- C. Hardware Provisions - Frames shall be prepared at the factory for the specified hardware. Frames shall be mortised, reinforced, drilled, and tapped for mortised hardware and shall be reinforced for surface-applied hardware. Cover boxes shall be provided in back of all hardware cutouts.
- D. Connections and Fasteners - All standard and special clips, angles, and other connection or attachment members shall be furnished as indicated, specified, or required for proper installation.

## 3.2 DOORS

- A. Workmanship - Doors shall be rigid, neat in appearance, and free from defects. Molded members for glazed doors shall be formed straight and true, with joints coped or mitered, well formed, and in true alignment. All welded joints on exposed surfaces shall be dressed smooth so that they are invisible after finishing.
- B. Sizes and Clearances - Doors shall be 1 3/4 inches thick, of the sizes and design indicated. Clearances for doors shall be 1/8 inch at jambs and heads, 1/4 inch at meeting stiles of pairs of doors, and 3/4 inch at bottoms unless otherwise indicated or specified.
- C. Hardware Provisions - Doors shall be mortised, reinforced, drilled, and tapped for mortised hardware, and reinforced as required for surface-applied hardware. Reinforcing units shall be provided for locksets. A threshold shall be provided at the bottom of each exterior door.

## 3.3 ERECTION

- A. Door frames shall be erected plumb and true by skilled mechanics in accordance with the manufacturer's recommendations, subject to the following modifications.

Framing members shall be anchored to concrete and solid masonry units with masonry anchors, and to steel by machine screws. Anchors for head, jamb, and sill members shall be spaced not more than 24 inches apart.

Member-to-member connections shall be made with appropriate profile clips, or with angles at each side or level of the members jointed. Each clip or angle shall be fastened to each member with at least two stainless steel or cadmium-plated screws. Connections shall be water-tight and shall be sealed during erection in accordance with the manufacturer's recommendations and standard details.

Accessories shall be secured with countersunk stainless steel machine screws.

Hardware shall be carefully properly installed, doors hung, and each item of hardware lubricated and adjusted for perfect operation.

### 3.4 PROTECTION AND CLEANING

- A. Doors, frames and appurtenances shall be protected during fabrication, shipment, site storage, and erection to prevent damage to materials or finished work. Damaged doors and framing members will be rejected and shall be replaced with undamaged units.

After completion of construction, protective materials shall be removed and all steel work shall be washed with a mild solution of soap and water and then rinsed with clean water.

**END OF SECTION**

## **SECTION 08305**

### **ACCESS DOORS AND PANELS**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION**

- A. This section includes ceiling access door and frame units

##### **1.2 Submittals**

- A. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- B. Manufacturer's Installation Instruction: Indicate installation instructions.

#### **PART 2 - MATERIALS**

##### **2.1 ACCESS PANELS AND PANEL ASSEMBLIES**

- A. Ceilings, Unless Otherwise Indicated:
  - 1. Location: As indicated on drawings
  - 2. Manufacturers:
    - a. ACUDOR Products Inc.
    - b. Babcock–Davis
    - c. Milcor, Inc.

#### **PART 3 - EXECUTION**

##### **3.1 EXAMINATION**

- A. Verify that rough openings are correctly sized and located

##### **3.2 PREPERATION**

- A. Prepare surfaces using methods recommended by the manufacturer for applicable substrates in accordance with project conditions

### 3.3 INSTALLATION

- A. Install units in accordance with the manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place
- C. Position units to provide convenient access to conceal equipment when necessary

**END OF SECTION**



## SECTION 08330

### OVERHEAD COILING SERVICE DOORS

#### PART 1 GENERAL

##### 1.1 SECTION INCLUDES

- A. Motorized Overhead coiling service doors. Door sizes shall be as listed in the door schedule on the drawings.

##### 1.2 DESIGN / PERFORMANCE REQUIREMENTS

- A. Overhead coiling service doors:
  - 1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components.
  - 2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
- B. Overhead coiling insulated doors:
  - 1. Wind Loads: Design door assembly to withstand wind/suction load of 20 psf (958 Pa) without damage to door or assembly components.
  - 2. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
- C. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer for each type of door. Provide secondary components from source acceptable to manufacturer of primary components.
- D. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

##### 1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Details of construction and fabrication.
  - 4. Installation instructions.
- C. Shop Drawings: Include detailed plans, elevations, details of framing members, anchoring methods, required clearances, hardware, and accessories. Include relationship with adjacent construction.
- D. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- E. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

#### 1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in performing Work of this section with a minimum of five years experience in the fabrication and installation of security closures.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Protect materials from exposure to moisture. Do not deliver until after wet work is complete and dry.
- C. Store materials in a dry, warm, ventilated weathertight location.

#### 1.6 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

#### 1.7 COORDINATION

- A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

### **PART 2 PRODUCTS**

#### 2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Overhead Door Corp., 2501 S. State Hwy. 121, Suite 200, Lewisville, TX 75067. ASD. Tel. Toll Free: (800) 275-3290. Phone: (469) 549-7100. Fax: (972) 906-1499. Web Site: <https://www.overheaddoor.com/home> E-mail: [sales@overheaddoor.com](mailto:sales@overheaddoor.com), or equal.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01600.

#### 2.2 OVERHEAD COILING SERVICE DOORS

- A. Heavy Duty Industrial Doors: Overhead Door Corporation, 620 Series Stormtite Service Doors (Galvanized steel unless otherwise noted), or equal.
  - 1. Curtain:
    - a. Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.

- b. Flat profile type F-265 for doors up to 18 feet 4 inches (5.59 m) wide, fabricated of:
    - 1) 22 gauge galvanized steel.
- 2. Finish:
  - a. Galvanized Steel:
  - b. Slats and hood galvanized in accordance with ASTM A 653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester top coat.
    - 1) Non-galvanized exposed ferrous surfaces shall receive one coat of rust-inhibitive primer.
    - 2) Top Coat Color:
      - (a) Powder coating finish in color as selected by Owner from manufacturer's standard colors.
- 3. Weatherseals:
  - a. Vinyl bottom seal, exterior guide and internal hood seals.
  - b. Interior guide weatherseal.
  - c. Lintel weatherseal.
- 4. Bottom Bar:
  - a. Extruded aluminum for doors up to 15 feet 4 inches (4.67 m) wide.
  - b. Two galvanized steel angles.
- 5. Guides:
  - a. Guides weatherstripped with a vinyl weather seal at each jamb on the exterior curtain side.
  - b. Three Structural steel angles with powder coated finish minimum thickness of 0.18 inch.
- 6. Brackets:
  - a. Galvanized steel to support counterbalance, curtain and hood.
- 7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe barrel, supporting the curtain with deflection limited to 0.03 inch per foot of span. Counterbalance is adjustable by means of an adjusting tension wheel.
- 8. Hood: Provide with internal hood baffle weatherseal.
  - a. 24 gauge galvanized steel with intermediate supports as required.
- 9. Electric Motor Operation: Provide UL listed electric operator, size per electrical equipment schedule as recommended by manufacturer to move door in either direction at not less than 2/3 foot nor more than 1 foot per second.
  - a. Sensing Edge Protection:
    - 1) Pneumatic sensing edge: or
    - 2) Electric sensing edge.
  - b. Operator Controls:
    - 1) Push-button operated control stations with open, close, and stop buttons.
    - 2) Controls for interior location.
    - 3) Controls surface mounted.
  - c. Motor Voltage: 115/230 single phase, 60 Hz.
- 10. Wind load Design:
  - a. Standard wind load shall be 20 PSF.
- 11. Locking:
  - a. Interior bottom bar slide bolt with chain hoist operation.
  - b. Interior slide bolt lock for electric operation with interlock switch.
- 12. Wall Mounting Condition:

- a. Face-of-wall mounting.
- B. Heavy Duty Insulated Industrial Doors: Overhead Door Corporation, 625 Series Stormtite Service Doors (Galvanized steel unless otherwise noted), or equal.
  - 1. Insulated slats (R7). All other features as listed above for Stormtite uninsulated service door.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify opening sizes, tolerances and conditions are acceptable.
- B. Examine conditions of substrates, supports, and other conditions under which this work is to be performed.
- C. If substrate preparation is the responsibility of another installer, notify Owner of unsatisfactory preparation before proceeding.

#### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

#### **3.3 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 16150. Complete wiring from disconnect to unit components.
- F. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07900.
- G. Install perimeter trim and closures.
- H. Instruct Owner's personnel in proper operating procedures and maintenance schedule.

#### **3.4 ADJUSTING**

- A. Test for proper operation and adjust as necessary to provide proper operation without binding or distortion.
- B. Adjust hardware and operating assemblies for smooth and noiseless operation.

### 3.5 CLEANING

- A. Clean curtain and components using non-abrasive materials and methods recommended by manufacturer.
- B. Remove labels and visible markings.
- C. Touch-up, repair or replace damaged products before Substantial Completion.

### 3.6 PROTECTION

- A. Protect installed products until completion of project.

**END OF SECTION**

**SECTION 08710**  
**DOOR HARDWARE**

**PART 1 - GENERAL**

1.1 DESCRIPTION

- A. This section covers finish hardware for exterior and interior doors.

1.2 GENERAL

- A. All door hardware shall be from the same manufacturer, and all locksets shall be keyed alike with two keys furnished for each lock, or a total of ten keys, whichever is less.

1.3 SUBMITTALS

- A. The Contractor shall submit a complete schedule of door hardware indicating the manufacturer's name, number, and finish.

1.4 TEMPLATES

- A. Each hardware manufacturer shall deliver to the door and frame manufacturer a template for each item of mortised and surface-applied hardware.

**PART 2 - MATERIALS**

2.1 MANUFACTURERS

Hinges	Stanley, Hager, Lawrence, or equal
Locksets, latchsets cylinders & padlocks	Schlage, Yale, Corbin Russwin, or equal
Closers & brackets	LCN, Corbin Russwin, or equal
Holders, bumpers & silencers	Baldwin, Russwin Corbin, Ives or equal
Thresholds & drip caps, extruded	Wooster, Reese, May, or equal
Thresholds, cast, abrasive	Wooster, American Abrasive, Pemko, or equal
Push plates, pull plates, & kickplates	Cipco, Baldwin, Quality, or equal
Weatherstripping	Reese, Zero, Pemko or equal

2.2 PRODUCTS

- A. Butt hinges. Where doors are required to swing 180 degrees, hinges shall have sufficient throw to clear the trim. Outswing exterior doors shall have non-removable pins. Butts

shall be heavy duty, 4-1/2" x 4-1/2" Stanley No. FBB179-26D or FBB179-32D, as required, or equal.

- B. Locksets. Locksets shall be heavy duty sets equal to Schlage No. D50PD-ATH-626 Entrance; D405-ATH-626 Restroom; D80PD-ATH-626 Storage/Mech.
- C. Latchsets. Latchsets shall be heavy duty sets equal to Schlage No. D105-ATH-626.
- D. Closers. Closers shall be full rack and pinion, hydraulic closers designed for use on exterior doors with hold-open device equal to LCN Series, as required.
- E. Bumpers. Bumpers shall be wall-mounted on all interior doors swinging into a wall or partition. Floor- or slab-mounted bumpers shall be provided on exterior doors to prevent door swing beyond 120 degrees or to point 4" before obstruction.
- F. Threshold. Thresholds shall be equal to Pemko extruded aluminum thresholds, sized to match the door.
- G. Miscellaneous. Miscellaneous items not specifically described but required for a complete and proper installation shall be high-quality materials selected by the Contractor, subject to the approval of the Engineer.

## 2.3 HARDWARE SCHEDULE

- A. Hardware shall be furnished in accordance with the following schedule. Doors are listed by opening numbers with a complete set of hardware listed for each opening.
- B. Substitutions. Hardware is identified by manufacturer's name and catalog number. Similar hardware of other makes will be considered, provided full information is furnished with the request, including the manufacturer's name and catalog number. The Contractor shall furnish complete specifications and cuts of each item.
- C. Finish. Hardware shall in general have a Satin Chrome finish. Door closers and brackets shall have a primed finish. Machine screws, bolts, and other exposed attachments shall be finished to match hardware.
- D. Fire Door Hardware. All locksets, latchsets, and closers for fire doors shall be listed by, and shall bear the label of, Underwriter's Laboratories for the corresponding fire door rating.
- E. Manufacturers. Items indicated in the hardware schedule identify products required for each opening. Equivalent products of the other listed manufacturers will be acceptable, provided the basic requirements of type, function, and materials are met.

## 2.4 HARDWARE SCHEDULE

See Drawings for Hardware Schedule for the Colburn Buildings.

## **PART 3 - EXECUTION**

### **3.1 DELIVERIES**

- A. All items shall be stocked sufficiently in advance to ensure their availability and orderly installation into the work.

### **3.2 PACKAGING**

- A. Each item of hardware shall be packaged separately in an individual container complete with screws, keys, special wrenches, instructions, and installation templates necessary for accurately locating, setting, adjusting, and attaching hardware. Each container shall be marked with the number of the opening to which the hardware item is to be applied.

### **3.3 INSTALLATION**

- A. Hardware items shall be accurately fitted, securely applied, carefully adjusted, and lubricated in accordance with the manufacturer's instructions.
- B. Location. Before hardware is installed, the locations of mortise preparations and hardware reinforcements shall be checked and any necessary revisions made. Unless otherwise directed by the Engineer, the locations of hardware items shall be in accordance with DHI "Recommended Locations for Builders' Hardware for Standard Steel Doors and Frames".
- C. Thresholds. Thresholds shall have ends notched to fit the frame profile and shall be field-drilled to receive flush bolts where required. Where fastened to concrete, thresholds shall be anchored with 5/16-inch stainless steel flat head countersunk machine screws and expansion anchors spaced at eight-inch centers. Thresholds shall be set in mastic conforming with Fed Spec SS-C-153.

**END OF SECTION**



# **DIVISION 9**

## **FINISHES**

**SECTION 09250**  
**GYPSUM BOARD**

**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
  - 1. Interior gypsum board.
  - 2. Exterior gypsum board

1.3 SUBMITTALS

- A. Product Data: Manufacturer's data and certifications for each type of product indicated.

1.4 QUALITY ASSURANCE

- A. Moisture- and Mold-Resistant Assemblies: Provide and install moisture- and mold-resistant glass-mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C 630 and ASTM C 1177 where indicated on Drawings and in all locations which might be subject to moisture exposure during construction.
- B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

1.5 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install interior products until installation areas are enclosed and conditioned.

- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## **PART 2 - PRODUCTS**

### **2.1 PANELS, GENERAL**

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### **2.2 INTERIOR GYPSUM BOARD**

- A. General: Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
  - 1. Basis-of-Design Product: The design for each type of gypsum board and related products is based on G-P Gypsum products named. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
    - a. American Gypsum Co.
    - b. National Gypsum Company.
    - c. CertainTeed Gypsum
    - d. USG Corporation.
    - e. Or equal.
- B. Type X:
  - 1. Basis-of-Design Product: G-P Gypsum; "ToughRock Fireguard Gypsum Board."
  - 2. Thickness: 5/8 inch.
  - 3. Long Edges: Tapered.
- C. Moisture and Mold Resistant Type:

Moisture and Mold Resistant type with moisture-resistant surfaces; G-P's "DensArmor Plus Paperless Interior Panel" panels, or equal, which have coated glass-mat facings and comply with both ASTM C 36/C 36M and ASTM C 1177/C 1177M.

Mold Resistant type; USG's "SHEETROCK Brand HUMITEK" panels and National Gypsum's "XP Wallboard," or equal, which are paper faced and comply with ASTM C 36/C 36M.

- 1. Basis-of-Design Product: G-P Gypsum; "DensArmor Plus Paperless Interior Panel"
- 2. Core: 1/2 inch or 5/8 inch Type X as noted.
- 3. Long Edges: Tapered.

## 2.3 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C 931/C 931M or ASTM C 1396/C 1396M, with manufacturer's standard edges.
  - 1. Basis-of-Design Product: The design for each type of gypsum board and related products is based on G-P Gypsum products named. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:
    - a. American Gypsum Co.
    - b. USG Corporation.
    - c. Certain Teed Gypsum.
    - d. Or equal.
  - 2. Core: 5/8 inch Type X as noted.
- B. Glass-Mat Gypsum Sheathing Board: ASTM C 1177/C 1177M.
  - 1. Product: Subject to compliance with requirements, provide "Dens-Glass Gold" by G-P Gypsum, or equal.
  - 2. Core: 5/8 inch, Type X as noted
  - 3. Long Edges: Square.

## 2.4 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
  - 1. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Exterior Trim: ASTM C 1047.
  - 1. Shapes:
    - a. Cornerbead.
    - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

## 2.5 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
  - 1. Basis-of-Design Product: "G-P Gypsum; ToughRock Tape"
  - 2. Interior Gypsum Wallboard: Paper.
  - 3. Exterior Gypsum Soffit Board: Paper.
  - 4. Glass-Mat Gypsum Wallboard: Paper or 10-by-10 glass mesh.

5. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
  6. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
    - a. Basis-of-Design Product: G-P Gypsum; ToughRock Sandable Setting Compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use manufacturer's recommended joint compound.
    - a. Basis-of-Design Product: G-P Gypsum; "ToughRock Ready Mix All-Purpose Joint Compound."
    - b. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping and drying-type, all-purpose compound as needed and as recommended by manufacturer.
    - a. Basis-of-Design Product: G-P Gypsum; "ToughRock Sandable Setting Compound ToughRock Ready Mix All-Purpose Joint Compound, or ToughRock Ready Mix Topping Joint Compound."
  4. Finish Coat: For third coat, use setting-type, sandable topping, and drying-type, all-purpose compound as needed and as recommended by manufacturer.
    - a. Basis-of-Design Product: G-P Gypsum; "ToughRock Sandable Setting Compound, ToughRock Ready Mix All-Purpose Joint Compound, and ToughRock Ready Mix Topping Joint Compound."
- D. Joint Compound for Exterior Applications:
1. Basis-of-Design Product: G-P Gypsum; "ToughRock Setting Compound."
  2. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sandable topping compound.
  3. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

### 3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Regular Type: As indicated on Drawings.
  - 2. Type X: Where required for fire-resistance-rated assembly.
  - 3. Type C: Where required for specific fire-resistance-rated assembly indicated.

4. Flexible Type: As indicated on Drawings. Apply in double layer at curved assemblies.
  5. Moisture- and Mold-Resistant Type: As indicated on Drawings.
- B. Single-Layer Application:
1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.
  2. On partitions/walls, apply gypsum panels unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    - b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
  3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
  4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints 1 framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
  2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  3. On Z-furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
  4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written recommendations and temporarily brace or fasten gypsum panels until fastening adhesive has set.

### 3.4 APPLYING EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
- B. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
1. Fasten with corrosion-resistant screws.
  2. Calk to seal.

### 3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Interior Trim:
  - 1. Cornerbead: Use at outside corners unless otherwise indicated.
  - 2. Bullnose Bead: Use where indicated.
  - 3. LC-Bead: Use at exposed panel edges as needed.
  - 4. L-Bead: Use where indicated.
  - 5. U-Bead: Use at exposed panel edges as needed.
  - 6. Curved-Edge Cornerbead: Use at curved openings.
- C. Exterior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.
  - 2. LC-Bead: Use at exposed panel edges as needed.
- D. Aluminum Trim: Install in locations as needed or as indicated on Drawings.

### 3.6 FINISHING GYPSUM BOARD

- A. General. The Contractor shall inspect all areas to be joint treated, making sure that the gypsum wallboard fits snugly against the supporting framework. In areas where joint treatment and compound finishing will be performed, the temperature shall be not less than 55° F for 24 hours before beginning treatment, for the entire period of treatment, and until joint and finishing compounds have dried.
- B. Finish Level: Achieve Level 4 finish typical
- C. The joint treatment and finishing compound shall be applied by machine or hand tools. A minimum drying time of 24 hours between coats shall be provided. Additional drying time shall be provided in poorly ventilated areas.
- D. Embedding Compound. Embedding compound shall be applied to gypsum wallboard joints and fastener heads in a thin, uniform layer. The compound shall be spread not less than three inches wide at the joints. The reinforcing tape shall then be centered in the joint and embedded in the compound before a thin layer of compound is spread over the tape. After this treatment has dried, a second coat of embedding compound shall be applied to joints and fastener heads, spread in a thin, uniform coat to not less than six inches wide at joints, and feather edged. When thoroughly dry, the wall shall be sanded to eliminate ridges and high points.
- E. Finishing Compound. After the embedding compound is thoroughly dry and has been completely sanded, a coat of finishing compound shall be applied to all joints and fastener heads. This coat shall be feathered to not less than 12 inches wide. When thoroughly dry, the Contractor shall sandpaper to obtain uniformly smooth surfaces, taking all necessary care not to scuff the paper surface of the wallboard. Unless otherwise indicated on the drawings, a light knock-down texture shall be applied prior to painting.



### 3.7 CORNER TREATMENT

- A. Internal Corners. Internal corners shall be treated as specified for joints, except that the reinforcing tape shall be folded length-wise through the middle and fitted neatly into the corner.
- B. External Corners. Corner beads fitting neatly over the corner and secured with the same type fasteners used for applying the wallboard shall be installed on external corners. The fasteners shall be spaced approximately six inches on centers and shall be driven through the wallboard into the framing or furring member.

After the corner piece has been secured into position, the corner shall be treated with joint compound and reinforcing tape as specified for joints, feathering the joint compound out from eight to ten inches on each side of the corner.

### 3.8 OTHER METAL TRIM

- A. General. The Plans do not attempt to show all locations and all requirements for metal trim in connection with the work of this section. The Contractor shall carefully study the Plans and the installation and shall provide in place all metal trim normally recommended by the manufacturer of the wallboard used.
- B. Installation. Metal trim shall be installed in strict accordance with the manufacturer's recommended methods of installation; however, no less embedment and finishing than specified above for corner treatment shall be provided.

### 3.9 APPLYING TEXTURE FINISHES

- A. Surface Preparation and Primer: Prepare and apply primer to gypsum panels and other surfaces receiving texture finishes. Apply primer to surfaces that are clean, dry, and smooth.
- B. Texture Finish Application: Mix and apply finish using powered spray equipment, to produce a uniform texture matching approved mockup and free of starved spots or other evidence of thin application or of application patterns.
- C. Prevent texture finishes from coming into contact with surfaces not indicated to receive texture finish by covering them with masking agents, polyethylene film, or other means. If, despite these precautions, texture finishes contact these surfaces, immediately remove droppings and overspray to prevent damage according to texture-finish manufacturer's written recommendations.

### 3.10 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

### 3.11 CLEANUP

- A. The Contractor shall use all necessary care during the execution of this portion of the work to prevent scattering of gypsum wallboard scraps and dust and to prevent tracking of joint and finishing compound onto floor surfaces. At the completion of each segment of installation in a room or space, the Contractor shall promptly pick up and remove from the working area all scraps, debris and surplus material of this section.

**END OF SECTION**

## SECTION 09900

### PAINTING

#### PART 1 - GENERAL

##### 1.1 DESCRIPTION

- A. Work included. This section includes the painting and finishing of all exterior and interior exposed surfaces listed on the Painting Schedule in Part Three of this section.
- B. Work not included. This section does not include painting which is specified under other sections of this Specification.

Unless otherwise indicated, cosmetic painting is not required on surfaces in concealed areas and inaccessible areas such as furred spaces, foundation spaces, utility tunnels, pipe spaces, and duct shafts.

Metal surfaces of anodized aluminum, stainless steel, A588 weathering steel, chromium plate, copper, bronze, and similar materials will not require painting under this section, except as may be specified herein.

Moving parts of operating units, mechanical or electrical parts such as valve operators, linkages, sinkages, sensing devices and motor shafts shall not be painted, unless otherwise indicated.

Required labels or equipment identification, performance rating, name, or nomenclature plates shall not be painted over.

- C. Definitions. The term "paint", as used herein, means all coating systems materials including primers, emulsions, epoxies, enamels, sealers, fillers, and other applied materials whether used as primer, intermediate or finish coats.

##### 1.2 QUALITY ASSURANCE

- A. Qualifications of Workmanship. The Contractor shall provide at least one person who shall be present at all times during the execution of the work of this section who shall be thoroughly familiar with the specified requirements and the materials and methods needed for their execution, and who shall direct all work performed under this section.

In addition, the Contractor shall provide adequate numbers of workmen skilled in the necessary crafts and shall properly inform them of the methods and materials to be used.

In acceptance or rejection of the work of this section, the Engineer will make no allowance for lack of skill on the part of workmen.

- B. Paint coordination. The Contractor shall provide finish coats which are compatible with the prime coats used. In addition, he shall review other sections of the Specifications as required to verify the prime coats to be used and to assure compatibility of the total coating system for the various substrata.

Upon request, the Contractor shall furnish information on the characteristics of the specific finish materials to ensure that compatible prime coats are used. The Contractor shall provide barrier coats over noncompatible primers or remove the primer and reprime as required.

The Contractor shall notify the Engineer in writing of any anticipated problems in using the specified coating systems over prime coating supplied under other sections.

### 1.3 SUBMITTALS

- A. The following submittals shall be required:
  - 1. A complete materials list of all items proposed to be furnished and installed under this section;
  - 2. Color chips for each proposed coating;
  - 3. Manufacturers' specifications and other data required to demonstrate compliance with the specified requirements; and
  - 4. Two copies of manufacturers' specifications, including paint analysis and application instructions for each material for information only. In addition, the Contractor shall indicate by transmittal that a copy of each manufacturer's instructions has been distributed to the applicator.

### 1.4 PRODUCT HANDLING

- A. Delivery of materials. The Contractor shall deliver all materials to the job site in original, new and unopened containers bearing the manufacturer's name and label showing at least the following information:
  - 1. Name or title of the material;
  - 2. Fed. Sec. number, if applicable;
  - 3. Manufacturer's stock number;
  - 4. Manufacturer's name;
  - 5. Contents by volume for major constituents;
  - 6. Thinning instructions; and
  - 7. Application instructions.
- B. Storage of materials. The Contractor shall provide proper storage to prevent damage to, and deterioration of, paint materials.
- C. Protection. The Contractor shall use all means necessary to protect the materials of this section before, during, and after installation and to protect the work and materials of all other trades.
- D. Replacements. In the event of damage, the Contractor shall immediately make all repairs and replacements necessary to the approval of the Engineer and at no additional cost to the Owner.

### 1.5 JOB CONDITIONS

- A. Surface Temperatures. The Contractor shall not apply solvent-thinned paints when the temperature of surfaces to be painted and the surrounding air temperature are below 45°F,

unless otherwise permitted by the manufacturer's printed instructions and approved by the Engineer.

- B. Weather conditions. The Contractor shall not apply paint in snow, rain, fog, or mist; or when the relative humidity exceeds 85 percent; or to damp or wet surfaces, unless otherwise permitted by the manufacturer's printed instructions as approved by the Engineer. Applications may be continued during inclement weather within the temperature limits specified by the paint manufacturer during applications and drying periods.

#### 1.6 EXTRA STOCK

- A. Amount. Upon completion of the work of this section, the Contractor shall deliver to the Owner an extra stock equaling ten percent (10%) of each color, type and gloss of paint used on the work.
- B. Packaging. The Contractor shall tightly seal each container and clearly label it with the contents and location used.

#### 1.7 MANUFACTURER'S RECOMMENDATIONS

- A. Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting his coating materials, for preparation of surfaces for coating, and for all other procedures relative to coating shall be strictly observed. No substitutions or other deviations will be permitted without written authorization from the manufacturer.

### PART 2 - MATERIALS

#### 2.1 PAINT

- A. Design. The design is based on the use of paint products manufactured by Sinclair Paint Company, and the materials of that manufacturer are named in the Painting Schedule. Equal products of Tnemec, Sherwin-Williams, Columbia, Pratt & Lambert or other manufacturers approved by the Engineer may be substituted.
- B. General. The Contractor shall provide the best quality grade of the various types of coatings as regularly manufactured by paint materials manufacturers approved by the Engineer. Materials not displaying the manufacturer's identification as a standard best-grade product will not be acceptable.
- C. Durability. The Contractor shall provide paints of durable and washable quality. Paint materials which will not withstand normal washing as required to remove pencil marks, ink, ordinary soil, and similar materials without showing discoloration, loss of gloss, staining, or other damage shall not be used.
- D. Colors and glosses. The Contractor shall submit color sample to be used in the various types of paints specified, to the Engineer for selection and/or approval.
- E. Undercoats and thinners. The Contractor shall provide undercoat paint produced by the same manufacturer as the finish coat. Only those thinners recommended by the paint

manufacturer shall be used, and only to the recommended limits. Insofar as practicable, the Contractor shall use undercoat, finish coat and thinner material as parts of a unified system of paint finish.

- F. Standards. The Contractor shall provide paint materials which meet or exceed the standards listed for each application in the Painting Schedule in Part Three of this section.

## 2.2 APPLICATION EQUIPMENT

- A. General. For application of the approved paint, the Contractor shall use only such equipment as is recommended for application of the particular paint by the manufacturer of the paint, and as approved by the Engineer.
- B. Compatibility. Prior to the actual use of application equipment, the Contractor shall use all means necessary to verify that the proposed equipment is actually compatible with the material to be applied and that the integrity of the finish will not be jeopardized by use of the proposed application equipment.

## 2.3 OTHER MATERIALS

- A. All other materials not specifically described but required for a complete and proper installation of the work of this section shall be new, first quality of the respective kinds, and as selected by the Contractor subject to the approval of the Engineer.

# PART 3 - EXECUTION

## 3.1 SURFACE CONDITIONS

- A. Inspection. Prior to installation of the work of this section, the Contractor shall carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence. The Contractor shall also verify that painting may be completed in strict accordance with the original design and with the manufacturer's recommendations, as approved by the Engineer.
- B. Discrepancies. The Contractor shall not proceed in areas of discrepancy until all such discrepancies have been fully resolved.

## 3.2 MATERIALS PREPARATION

- A. General. The Contractor shall mix and prepare painting materials in strict accordance with the manufacturer's recommendations as approved by the Engineer. Materials not in actual use shall be stored in tightly covered containers. The Contractor shall maintain containers used in storage, mixing and application of paint in a clean condition, free from foreign materials and residue.
- B. Stirring. The Contractor shall stir all materials before application to produce a mixture of uniform density, and as required during the application of materials. Any surface film that may form shall not be stirred into the material, but shall be removed. If necessary, the material shall be strained before using.

### 3.3 SURFACE PREPARATION

- A. General. The Contractor shall perform all preparation and cleaning procedures in strict accordance with the paint manufacturer's recommendations, as approved by the Engineer. The Contractor shall remove all removable items which are in place and are not scheduled to receive paint finish, or provide a surface- applied protection prior to surface preparation and painting operations. Following completion of painting in each space or area, the Contractor shall reinstall the removed items, using workmen skilled in the necessary trades.

The Contractor shall clean each surface to be painted before applying paint or surface treatment. Oil and grease shall be removed with clean cloths and cleaning solvents of low toxicity and a flash point in excess of 100° F prior to the start of mechanical cleaning. Cleaning and painting shall be scheduled so that dust and other contaminants from the cleaning process will not fall onto wet, newly painted surfaces.

Unless otherwise specified herein, the coating manufacturer's printed recommendations and instructions for thinning, mixing, handling, applying, and protecting his materials, for preparation of surfaces for coating, and for other procedures relative to coating shall be strictly observed. No substitutions or other deviations will be permitted without written authorization from the manufacturer.

- B. Preparation of wood surfaces. The Contractor shall clean all wood surfaces until they are free from dirt, oil, and all other foreign substances. All finish wood surfaces exposed to view shall then be smoothed, using the proper sandpaper. Where so required, the Contractor shall use varying degrees of coarseness in sandpaper to produce a uniformly smooth and unmarred wood surface. Unless specifically approved by the Engineer, the Contractor shall not proceed with painting of wood surfaces until the moisture content of the wood is 12 percent or less as measured by a moisture meter.
- C. Preparation of metal surfaces. The Contractor shall thoroughly clean all metal surfaces until they are completely free from dirt, oil and grease. On galvanized surfaces, solvent shall be used for the initial cleaning, and then the surface shall be thoroughly treated with phosphoric acid etch. All etching solution shall be removed before proceeding. The metal surface shall be allowed to dry thoroughly before paint is applied.
- D. Preparation of concrete surfaces. New concrete surfaces, including floors, which are to be painted shall be prepared by removing all dirt, dust, efflorescence, oil or grease stains, or other foreign substances, by wire or fiber brushing or scrubbing, scraping, or other appropriate methods. Prior to mechanical cleaning, any oil or grease shall be removed with a solvent or detergent.

New concrete floors shall be flooded with muriatic acid solution mixed in the proportions of one part acid to four parts water, broomed, and then thoroughly rinsed with clean water. The floor surfaces shall be completely dry when painted.

### 3.4 PAINT APPLICATION

- A. General. The Contractor shall slightly vary the color of succeeding coats. No additional coats shall be applied until the complete coat has been inspected and approved. Only the inspected coats of paint will be considered in determining the number of coats applied.

The Contractor shall sand and dust between enamel coats to remove all defects visible to the unaided eye from a distance of five feet.

On all removable panels and all hinged panels, the Contractor shall paint the back sides to match the exposed sides.

- B. Drying. The Contractor shall allow sufficient drying time between coats. This drying period shall be modified as recommended by the material manufacturer to suit adverse weather conditions.

Oil-base and oleo-resinous solvent-type paints shall be considered dry for recoating when the paint feels firm, does not deform or feel sticky under moderate pressure of the thumb, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

- C. Brush Application. The Contractor shall brush out and work all brush coats onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, and other surface imperfections will not be acceptable.
- D. Spray Application. The Contractor shall confine spray application to metal framework and similar surfaces where hand brush work would be inferior. Whenever spray application is used, the Contractor shall apply each coat to provide the equivalent hiding of brush-applied coats. Doubling back with spray equipment for the purpose of building up film thickness of two coats in one pass shall not be allowed.
- E. Completed work. The completed work shall match the approved samples for color, texture and coverage. The Contractor shall remove, refinish or repaint all work not in compliance with specified requirements.

### 3.5 MATERIALS

#### A. PRIMERS AND PRETREATMENTS

Rust-Inhibitive	Universal type; Cook "391-R-259 Clorocon Barrier Coat"; Koppers "No. 10 Inhibitive Primer"; Mobil "13-R-50 Chromox Q.D. Primer"; Tnemec "77 Chem-Prime"; Rust- Oleum "1573 Rust-Inhibitive Primers"; or equal.
Vinyl Wash	MIL-P-15328; Cook "900-Y-2 Vinyl Wash Primer"; Koppers "801 Wash Coat"; Mobil "13-Y-8 Vinyl Wash Primer"; Tnemec "32-1210 Vino- line Wash Primer"; or equal.
Acrylic Emulsion	Rust-Oleum "5700 Rust-O-Crylic"; or equal.
Coal Tar	Koppers "Bitumastic Mill Undercoat"; Mobil "35-J-6 Bituminous Black"; or equal.



Vinyl	Ameron "Amercoat 86"; Cook "900-R- 014 Vinicon Primer"; Koppers "25 Vinyl Primer"; Mobil "80-R-8 Vinyl Primer;" Tnemec "33-1211"; Rust- Oleum "9000 High Build Vinyl; or equal
Epoxy Primer	Tnemec "66-1211 Epoxiline Primer"; Rust-Oleum "9369 Red Epoxy Primer"; or equal.
Alkyd	Promar 200 Alkyd Enamel Undercoater; or equal.
Wood Stain Penetrating Wood Stain	Pratt & Lambert "Tonetic" Wood Stain; or equal. "Penta" Fortified Wood Stain"Olympic" Weather Screen; or equal.
Zinc Rich (inorganic)	Ameron "Dimetcote 6", Carboline "Carbo Zinc 11"; Cook "411-A-101 Inorganic Zinc Coating"; Koopers "Inorganic Zinc No. 3"; Mobil "Mobilzinc 7"; Tnemec "92 Tneme- Zinc"; Rust-Oleum "5686 Inorganic Zinc Rich"; or equal.
Tie Coat (for Zinc Primer)	Koppers "25 Tie Coat"; Rich; or equal.
Latex Primer-Sealer	Cook "Corovel Latex Primer"; Pratt & Lambert "Vapex Wall Primer"; Mobil "77-W-1 Primer and Sealer"; Tnemec "51-792 PVA Sealer"; Promar 200 Latex Wall Primer; or equal.

#### B. INTERMEDIATE AND FINISH PAINTS

Semigloss Alkyd Enamel	Fed Spec TT-E-529; Cook "Shado- tone Satin Enamel"; Koppers "Gramortex Semi-Gloss"; Mobil "Series 31 Alkyd Satin Enamel"; Tnemec "Enduratone"; Rust-Oleum "New Color Horizons" Semi-gloss; Promar 200 Semi-Gloss Enamel; or equal.
Medium Consistency	Koppers "Bitumastic Super Service"; or equal.
Coal Tar	Black; Mobil "High-Build Bituminous Coating 35-J-10"; Porter "Tar- mastic 103"; Tnemec "46-450 Heavy Tnemecol"; or equal.
Thixotropic Coal Tar	MIL-C-18480; Koppers "Bitumastic No. 50"; Mobil "35-J-10 Hi- Build Bituminous Coating"; Tnemec "46-449 Heavy Duty Black"; or equal.
Latex Emulsion	Acrylic containing at least 50 per- cent by weight nonvolatile solids; Cook "827 Series Sulfide Fume Resistant Paint"; Koppers "600 Acrylic"; or Tnemec "Series 6 Tneme-Cryl"; Rust-Oleum "5900 Rust-O-Crylic"; or equal.

Polyamide Epoxy	Rust-Oleum "9500 High-Build Epoxy"; Tnemec "#66 Hi-Build Expoyline"; DuPont Corlar 26P; Dupont Corlar 823HB; or equal.
Urethane	Rust-Oleum "9400 Rust-O-Trane"; Tnemec "Series 70 Endura Shield"; or equal.
Semi Gloss Latex	Acrylic containing at least 50 per- cent by weight nonvolatile solids; Cook "A-Kryl-X Satin Latex Paint"; or Glidden "3700 Spread Latex Semi- Gloss Enamel", Promar 200 Latex Semi-Gloss Enamel; or equal.
Coal Tar Epoxy	Cook "Corotar"; Koopers "300-M Bitumastic"; Mobil "Sovapon Tar Coat 64-J-2"; Porter "Tarset Standard"; Tnemec "413 Coal Tar Epoxy; Rust-Oleum "A-93-7908"; or equal.
Concrete Floor Hardener	Shake on application; L & M "Quartz Plate", Euclid "Surfhard"; Master Builders "Mastercron", or equal, sealed as per manufacturer's recommendation Liquid application; Sonneborn "Lapidolith", or equal, sealed per manufacturer's recommendations
Vinyl	Ameron "Amercoat 33"; Cook Vinicon MW"; Koopers "35 HB Intermediate plus 401 Vinyl Finish"; Mobil "Series 80 Vinyl Enamel", Tnemec "Vinoline (Series 35)"; Rust- Oleum "9000 High Build Vinyl; or equal.
Clear Gloss Varnish	Cook "Timbre-tone Urethane"; Martin Senour "Astro-Var"; Pratt & Lambert "Varmor Clear Finish"; Mobil "38-V-23 Clear Urethane Gloss"; or equal.
Clear Satin Varnish	Cook "Timbre-tone Satin Varnish"; Pratt & Lambert "38 Satin Pale Trim Varnish"; Martin Senour "Astro- Var"; or equal.
Heat-Resistant	Rust-Oleum "4115 Heat Resistant"; or equal.
Aluminum	Ready-Mixed Aluminum; Mobil "37-A- 10 Heat Resisting Aluminum"; Tnemec "261 Hot Surface Aluminum"; or equal
Epoxy Floor Coating	50 percent solids epoxy floor covering with a slip-resistant surface; Tnemec "Series 67 Tneme- Tread" with 50-mesh silica for non- skid treatment, or equal.

### 3.6 MANUFACTURER REFERENCE

- A. Coating materials herein specified by name and/or manufacturer are intended to demonstrate the design intent and define the type and quality of coating desired. Other

coating of equal quality will be allowed only after appropriate submittals have been furnished and the written approval of the Engineer has been issued.

### 3.7 PAINTING SCHEDULE

- A. The following schedule lists paints for prime, intermediate and finish coats for surfaces to be painted. All exposed surfaces including sides and edges shall be painted. Painting systems shall conform to the finish schedules on the Drawings. All surfaces not scheduled on the Drawings shall conform to the Painting Schedule. Specific coating requirements listed in other sections of these specifications for equipment or structures shall take precedence over these schedules.

Surface to be Painted	Material
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B. Metal Surfaces

1. Exposed surface of shop-primed structural steel and steel framing members, motors, drives, pumps, equipment, and equipment enclosures, except galvanized surfaces, exterior locations.
 

Prime Coat	Epoxy Primer
Second Coat	Polyamide Epoxy
Third Coat	Polyamide Epoxy
2. Exposed surfaces of shop-primed structural steel, steel framing members, motors, drives, pumps, equipment, and equipment enclosures, except galvanized surfaces, interior locations.
 

Prime Coat	Rust Inhibitive
Second Coat	Gloss Alkyd Enamel
3. All exposed surfaces of cast iron and steel piping, hatches and miscellaneous accessories inside buildings and above grade outdoors, including valves, fittings, flanges, bolts, supports, guard posts, steel doors, and accessories therefore, railings, and including galvanized surfaces after proper priming.
 

Prime Coat	Rust Inhibitive
Second Coat:	Gloss Alkyd Enamel
4. All exposed surfaces of electrical conduit inside buildings, except banks of conduits in multiple layers hung from ceilings, including fittings, boxes, supports, and accessories therefore, after proper priming.
 

Prime Coat	Primer
Second Coat	Semi-Gloss Alk. Enam. Or Semi-Gloss Latex
5. All metal surfaces, unless otherwise specified, which will be submerged or buried, all or in part, including valves, valve boxes, weir plates, and scum baffles, but excluding piping laid in the ground and similar locations.  
All exterior surfaces of cast iron and steel piping exposed in manholes and similar locations.
 

Prime Coat	Self Priming
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- |  |            |                              |
|--|------------|------------------------------|
|  | First Coat | Medium Consistency Coal Tar, |
|--|------------|------------------------------|
6. All metal harness anchorage for buried piping and all aluminum surfaces in contact with concrete.
 

	Prime Coat	Self Priming
	First Coat	Thixotropic Coal Tar
	Second Coat	Thixotropic Coal Tar
- C. Concrete and Masonry Surfaces
1. Concrete surfaces below grade, outside surfaces.
 

	Prime Coat	Thixotropic Coal Tar
	Second Coat	Thixotropic Coal Tar
  2. Interior concrete floors
 

	Prime Coat	Floor hardener – spray applied except where an epoxy paint finish is noted in the drawings.
	Second Coat	Sealer per manufacturer's recommendations - except where an epoxy paint finish is noted in the drawings.
  3. Masonry Surface Above Grade.
 

	Not Used	
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- D. Miscellaneous Surfaces
1. Gypsum Wallboard.
 

	Prime Coat	Latex Primer-Sealer
	Second Coat	Semi-Gloss Latex
	Third Coat	Semi-Gloss Latex
	<b>or</b>	
	Prime Coat	Latex Primer Sealer
	Second Coat	Semi-Gloss Alkyd Enamel
	Third Coat	Semi-Gloss Alkyd Enamel
  2. Interior wood trim.
 

	Not Used	
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  3. Exposed vent, misc. piping, etc.
 

	Prime Coat	Rust Inhibitive
	First Coat	Gloss Alkyd Enamel
  4. Other
 

Other items requiring painting shall be coated as per the manufacturer's recommendations.

### 3.8 SURFACES NOT TO BE COATED

- A. The following listed items will not require coating:
1. Finished hardware, except where primed for paint
  2. Prefinished heating units and electrical panels
  3. Prefinished metal siding

4. Prefinished metal roofing
5. Steel members constructed of A588 weathering steel
6. Galvanized metal, except fasteners, piping and electrical conduit
7. Anodized aluminum or aluminum
8. All concrete surfaces except for outside surfaces of below grade walls.
9. Stainless steel, brass, bronze and chrome plated items
10. Items having factory finish other than prime coat only, conforming to these specifications.
11. Equipment nameplates
12. Exposed sections of machined shafts on motors, drives, etc.

**END OF SECTION**

# **DIVISION 11**

## **EQUIPMENT**

## SECTION 11200

### TRANSFER BUILDING TUNNEL SCALES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Report* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the Work necessary to furnish and install two 15-ft in-ground (pit) scales for the new Waste Transfer Building (WTB) tunnel for the Colburn Site. The scale manufacturer shall provide the scale, complete, with weight indicators (reader boards), which include three reader boards to be placed on the tipping floor level for front, rear, and total weights.
- B. Refer to other Specification sections and Drawings for other elements and features of the scale system to make it fully integrated and “turn-key.” Ensure the power and interfaces are either provided by the scale supplier or the electrical bid portion of the work.
- C. Performance Requirements:
  - 1. The new 15-ft scales shall be fully electronic, low profile, modular type concrete deck, designed to be placed in-ground (pit). The scales shall be a modular that is designed for field pouring of concrete.
  - 2. The scales will be used to weigh transfer trailers parked in the tunnel (lower) level of the new WTB. The scales are arranged to be used with either the trailer connected to a “yard goat” or with the landing gear down. Field fit a location for a thick (heavy gauge), metal plate to be embedded into the concrete deck for where the landing gear with drop, providing adequate size to be flexible in how the trailer is parked under the loading chutes. Submit plan and coordinate with the Engineer.
- D. Related Sections include the following:
  - 1. Division 3 Section "Concrete" for concrete related elements.
  - 2. Divisions 2, 15, and 16 Sections for installing underground mechanical and electrical utilities and buried mechanical and electrical structures.

##### 1.3 QUALITY ASSURANCE

- A. The manufacturer of the new scales shall have been in the business of design and manufacturing of similar type scales for at least 10 years and have been represented in the State of Idaho by a complete sales and service organization for the preceding 5 years. Local parts and service must be available on a 24-hour-day, 7-day-week basis. A service list of customers with similar type scales, covering at least the past 5 years, and a list of

the servicemen with their experience record must be submitted to assure that adequate, skilled manpower is available at all times to maintain scale repair service. The manufacturer shall also be the same as the new 80-ft automated commercial scale.

- B. Scales shall be built in accordance with standards of the American Society of State and Highway Officials and the Scale Manufacturers Association. Performance:
- C. The scales shall perform automatically as specified, with all components compatible for the intended use. The performance requirements and tolerance values shall be as set forth for vehicle scales in the Scale Code of National Bureau of Standards Handbook H-44 and shall be met in every respect.
- D. The scale manufacturer shall provide a Certificate of Conformance to the standards. The installation shall be completed and tested under the Contractor's direction to meet the approval of and to obtain the Seal of Certification from Idaho regarding automatic weight indicators.
- E. The scale in its entirety shall be manufacturer's standard design, without modification for this project, and shall have been proven in similar installations and shall have NTEP (National Type Evaluation Program) certificate for scale and load cells.
- F. Approach slabs shall comply with the requirements set forth for vehicle scales in the Scale Code of National Bureau of Standards Handbook H-44.

#### 1.4 MANUFACTURER'S SERVICES

- A. A manufacturer's representative for the equipment specified shall be present at the Job Site for 2 days for certification of the installation/commissioning, startup assistance. Refer to Section TESTING. Travel time shall not be included in the 2 days at the Job Site. Refer also to Section TRAINING for training requirements. This 2-day training may be conducted concurrently with the automated commercial scale system.

#### 1.5 SUBMITTALS

- A. All materials and products associated with the scale and scale system for a complete "turn-key" system.
- B. Manufacturer shall provide documentation pertaining to installation, standard settings, and foundation plans.
- C. Complete detailed shop drawings for the scale, scale foundation (stamped by a licensed engineer in the State of Idaho), list of conduit requirements, and manufacturer's brochures for the new scale and associated equipment to be furnished.
- D. Contractor must provide all Shop Drawings within 30 days of contract award and must be approved by the Engineer prior to starting scale foundation construction.
- E. Complete schematic diagrams and Operating and Maintenance Manuals and Maintenance Summary Sheets for the equipment specified herein shall be furnished.



- F. Certificate of conformance with the Scale Code of National Bureau of Standards Handbook H-44.
- G. Idaho Seal of Certification by Weights and Measures.
- H. O&M Manual and maintenance summary sheets.
- I. Training Manuals.

## 1.6 WARRANTY

- A. Warranty in writing for the guarantee of the operating performance of the scale and all related equipment and components for a period of 2 years upon certified completion of the entire Contract (but no sooner than Final Completion). In the event of any defect during this period attributable to workmanship under this Contract, make corrective repairs within 5 days of written notice by the Owner so specifying the nature of the defect.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER / VENDOR

- A. Materials, equipment, and components specified in this Section shall be products with acknowledgement and understanding of the compatibility and integration of their scale with the scaling software and hardware. Scale manufacturer shall be the same as the automated commercial truck scale.
- B. The vendor or representative of the manufacturer shall be fully certified and licensed to represent such company with certifications for use of their product.

### 2.2 SCALE FOUNDATION

- A. Scale Pit foundation with 10-foot long approach slabs at each end, in compliance with requirements of Handbook H-44.
- B. Concrete for scale foundation and approach slabs shall comply with requirements of Division 3, Concrete. Refer also to the Drawings. Concrete for the scale deck shall be as specified by the scale manufacturer.

### 2.3 SCALES

- A. Contractor shall coordinate with the scale manufacturer for products and materials that the scale manufacturer will provide preassembled, those that will be provided and require Contractor installation, and those that will be provided and installed by the Contractor. This includes, but is not limited to, the scale, the readout boards, all scale hardware, all conduits, all wires and cables connecting the scale, weigh station, and all other ancillaries to provide a complete, fully operational and integrated scaling system.

- B. The scales shall be dual platform fully electronic, low profile, modular type concrete deck truck scale systems, designed to be mounted in a pit-type foundation. The scales shall be composed of 2 each single module 2-section systems.
- C. The scales shall be a fully electronic, low profile, concrete deck design truck scale. The scale platform shall be 100 percent designed and manufactured in the United States of America. The scale platform, load cells, and digital indicators shall be 100 percent assembled in the USA. The scale shall be a Rice Lake Weighing Systems Model EZ159-SC-60-OTR, or approved equal, that will meet the following minimum standards:
1. The scale shall have a full-scale capacity of 60 tons (120,000 lbs.) with a displayed resolution of 100,000 lbs. x 20 lbs. in accordance with NIST, Class IIIL devices.
  2. The scale shall be a fully electronic design. The scale weighbridge will consist of factory welded modules having a total longitudinal span of 15' (14'-10.5") and platform width of 9' (8'-10.5"). No field assembly or welding shall be allowed. Mechanical lever systems are not acceptable.
  3. Each scale module shall be designed with a Concentrated Load Capacity (CLC) of 50 tons (100,000 lb.), as defined by NIST. When the CLC is applied at midspan on a module, according to NIST regulations, the maximum stress of the steel shall not exceed 17,500 psi as determined by Finite Element Analysis (FEA) software. The deflection at this loading condition shall not cause the scale to exceed the allowable accuracy tolerance as specified by NIST in Handbook 44.
  4. Each scale provided will have an unobstructed weighing surface of 9' (8'-10.5") wide by 15' (14'-10.5") in length. A minimum clearance of 6 inches shall be provided between the concrete floor and the bottom of the weighbridge.
  5. The scale modules shall be designed as such to eliminate use of grout plates requiring setting and leveling prior to arrival of the scale at job site. A maximum of two drilled anchors (3/4" x 7") shall be provided with each load cell stand.
  6. The scale system shall be a full electronic design with internal self-checking weighbridge. Weighbridges using bumper bolts, externally fixed check rods or embedded bumper plates in the end walls will not be permitted.
  7. Minimum weighbridge thickness shall be 12 inches. The scale shall be an open-bottom design. Weighbridges that utilize a sealed bottom plate for structural strength shall not be permitted.
  8. Access covers to the load cells shall be from the top of the scale and shall be boltless in design. Cover plates will be reinforced to adequately handle axle traffic over the covers and will be kept in place with 1/2" diameter x 1" long steel dowels. Cover plates utilizing bolts of any type shall not be permitted.
  9. A 6-inch concrete deck shall be supported with a minimum of two (2) 12-inch-wide flanges, 14 lb. per foot, and four (4) 6-inch-wide flange 9 lb. per foot. structural longitudinal beams, welded to top flange of beam and module end plate. Only structural wide flange beam construction shall be allowed. Weighbridge designs utilizing junior beams or bent plate shall not be permitted.
  10. The scale shall have a maximum span deflection ratio of no less than 1:1100 under legal highway loading at mid span of module.
  11. The entire length and width of the concrete deck shall be supported by an intricate steel support structure. Only structural wide flange beam construction shall be allowed. Weighbridge designs utilizing junior beams and/or bent plate shall not be permitted.

12. The concrete deck shall be field poured at the job site and have a cured strength of no less than 5,000 psi at 28 days. The concrete deck shall have a minimum thickness of 6 inches with one mat of #4 reinforcing rod on 12-inch centers.
13. Pre-poured, pre-cast or pre-stressed, concrete decks shall not be permitted.
14. The internal steel support structure for concrete shall consist of a minimum of two (2) 12-inch-wide flanges, 14 lb. per foot, main beams and 6-inch-wide flange, 9 lb. per foot, crossmembers.
15. The scale weighbridge shall be designed to accommodate up to 250 trucks per day for a period of 25 years without weighbridge fatigue.
16. Shear cut galvanized strips shall be attached to the support beams and serve as a forming pan for the concrete deck.
17. The entire bridge assembly shall be cleaned prior to the addition of any coatings or paint to the weighbridge modules. The customer reserves the right to inspect the steel surfaces prior to application of any coatings to prepared steel surfaces. All steel surfaces shall be free of welding gases, residue, oil, mill scale and rust.
18. All steel elements shall be steel shot blasted to SSPC-A-SP6 standards.
19. All visible steel surfaces shall receive a 3-5 mill application of a high-solids urethane primer and a high solids acrylic urethane topcoat to a finish of 2-3 mill thickness.
20. Concrete elements in the weighbridge shall be utilized in a compression application above the neutral axis of the structure. Weighbridge designs
21. allowing the concrete to extend below the neutral axis, subjecting the entire concrete deck to tension or bending forces, shall not be permitted.
22. A full-length diamond plate steel removable centered flush mounted traffic rated access plate running the full length of the scale deck shall be provided for ease of access to pit for clean out.
23. Structural steel elements shall have a combined minimum weight of 25,800 lb.
24. The scale shall be NTEP Certified and shall meet the requirements set forth by the NIST Handbook 44 for Class III-L devices. The bidder shall submit a current copy of Certificate of Conformance with bid.
25. Cover plates shall be reinforced to adequately handle axle traffic over the covers. Cover plates utilizing bolts of any type shall not be permitted.

D. Load Cells and Junction Boxes

1. Load cells are rigidly mounted in fabricated steel strands to traffic flow. The suspension system shall be forged single link to allow self-centering and a free-floating platform. Provide equal and consistent and evenly distributed force to the load cell. Load cells are totally self-contained and come complete and cabling as needed and coordinated with electrical. Compression or rocker style load cells shall not be permitted.
2. Load cells will be of the analog type and have a minimum capacity of 75,000 lb. each with an overload safety factor of 150 percent. Scales utilizing a lower capacity load cell than 75,000 lb. will not be permitted.
3. Systems utilizing proprietary, internal circuitry to convert analog to digital load cell signal within the load cell shall not be permitted.
4. Scales utilizing adjustable bumper bolts or embedded plates in the wall to minimize movement of the bridge shall not be allowed
5. All access to load cells will be from the top of the scale through formed boltless steel access panels. Covers should be form fitted and should be accessible without use of tools.
6. Steel conduit will be provided within the weighbridge for load cell cable runs.

7. A flexible screw-type conduit fitting shall be provided at each load cell. Load cell cable shall be totally enclosed within permanent conduit provided within the weighbridge. Load cells using connectors of any type will not be permitted. Braided metal cable covering shall not be used in place of steel flex conduit or hardened steel conduit.
8. Load cells shall be non-proprietary in design, including both mechanical operation and electronic transmission of data. Manufacturers using proprietary load cell technology available from a single source will not be permitted.
9. Load cells shall be of 4340 alloy steel nickel plated and shall be sealed with a minimum IP67 rating
10. Replacement load cells shall be available from a multitude of vendors nationally and shall not be single sourced or of a proprietary design.
11. Fiberglass Reinforced Polyester (FRP) junction box with formed contoured edges and gasketed top access. Junction box shall have a Gore-Tex™ single directional membrane vent. Steel junction boxes shall not be permitted.
12. Load cell stands will be flush mounted to concrete piers and anchored using wedge locks or similar bolts. A maximum of (2) 3/4" x 7" anchor bolts will be required per stand and will be included in the cost of the scale. Grout plates or embedded items in the foundation concrete will not be allowed.
13. A 1-inch braided copper transient bypass cable shall be provided at each load cell from the weighbridge to the base stand.
14. UPS Duplex Voltage regulating transformer, or equal.
15. UJB-3T6 DC Transient circuitry protection or equal.
16. Load cells shall be warranted a full five years against failure of all types, including lightning or surge voltage.
17. A single-point grounding system will be provided. Systems utilizing a multiple point ground will not be permitted.

E. Digital Instrumentation

1. The scale instruments shall be a Rice Lake Weighing Systems 920i® programmable HMI indicator / controller or approved equal.
  - a. The scale instrument shall be NTEP Certified and meet or exceed all specifications set forth by NIST, Handbook 44 for Class II, III, and IIIL devices. Additionally, the instrument shall meet or exceed approvals for UL, C-UL and CE. The manufacturer, on request, shall provide a Certificate of Conformance (COC) to these standards.
  - b. The scale instruments shall be housed in all stainless steel, NEMA Type 4X/IP66 enclosure.
  - c. The instrument shall be microprocessor-based, 2-channel indicator with total scale summing capabilities.
  - d. The scale instrument shall be fully programmable and configurable according to the needs of the application. Custom programming for the application will be available through common programming techniques.
  - e. The scale display shall be a backlit LCD graphical display with minimum size of 3.4" high x 4.6" wide with characteristics from 25" to 1.2" high. It must be capable of displaying alpha and numeric characters or graphic images. This is the display where the tunnel where the scale interface system is located. Reader boards (remote displays) shall be in addition to this display.
  - f. Remote Displays – Scale system to be furnished with three (3), Rice Lake Laser Light 2, or approved equal, 4 inch remote displays for displaying the weights of Scale 1, Scale 2, and the Total summed weight of the individual

- scales to be placed on the tipping floor level next to the loading chutes and at a readable height and location, as approved by the Engineer.
- g. The instrument shall allow connection of a QWERTY-type, computer-style keyboard.
  - h. The front panel of the instrument shall have the following operational keys as standard with tactile feedback:
    - 1) Zero
    - 2) Print
    - 3) Gross/Net
    - 4) Clear
    - 5) Tare
    - 6) Decimal Point
    - 7) Units
    - 8) Numeric 0-9
  - i. The instrument shall have the following custom softkeys: five user-defined function keys, driver number, contract number, weigh-in and weigh-out.
  - j. The instrument shall have the following displayed operational annunciators: gross, tare, net, zero, motion, and three units of measurement.
  - k. The scale instrument shall have the capability of powering up to 16 – 350 Ohm load cells.
  - l. The instrument shall have the ability to display both gross and net weights and the ability to recall gross or tare weights in net mode.
- 2. The instrument shall have the ability to provide in/out, gross/tare/net calculation of individual truck weights and storage for the following information:
    - a. 1,000 open transactions
    - b. 1,000 tare weights
    - c. Database report
  - 3. The instrument shall have a minimum of four standard bi-directional serial ports with the following configurations available:
    - a. Com. 1 – RS-232
    - b. Com. 2 – RS-232, 20mA current loop
    - c. Com. 3 – RS-232, 20mA current loop
    - d. Com. 4 – RS-232, RS-485, 20mA current loop
  - 4. Setpoints: Four digital I/O ports onboard.
  - 5. The scale instrument shall be designed to provide noise protection for RFI, EMI and ESD.
  - 6. The excitation voltage shall be 10 VDC.
  - 7. The instrument shall have an automatic zero tracking feature that will be programmable and in compliance with NIST, Measurement Canada and OIML regulations.
  - 8. The instrument shall be fully programmable through the front panel.
  - 9. The instrument shall include as standard surge voltage protection as recommended by the manufacturer
  - 10. The digital instrument shall be warranted by the manufacturer for two years from date of installation.
  - 11. The instrument shall have a multi-level digital filtering system for environmental noise or vibration.
  - 12. Individual load cell monitoring and system diagnostics shall be available.
  - 13. The scale instrument shall have an internal resolution of 8.000.000 counts.
  - 14. Operating temperature for the instrument shall be 14°F to 104°F
  - 15. The scale instrument shall have the ability to be panel mounted.

16. Customized programmable print formats including 20 auxiliary print formats shall be available.
17. Operational power input shall be 115 or 230 VAC,  $\pm 10$  percent @ 3.15 Amp maximum. 50/60 Hz single phase.
18. The scale instrument shall have the capability of receiving custom programs with up to 256 display widgets and 10 screens.
19. The instrument shall have a real-time clock and battery-backed feature.
20. A/D conversion rate shall be selectable from 7.5 Hz to 960 Hz.
21. Multi-range/internal selection for setting two or three weight ranges with different division sizes.

### **PART 3 - EXECUTION**

#### **3.1 SCALE**

- A. The scale and all appurtenances shall be installed by the Contractor in accordance with the scale manufacturer's instructions and approved Shop Drawings.
- B. Contractor shall cover painted surfaces with tape or other means during installation to avoid damage to paint surface and to minimize touchup requirements.
- C. A straight approach of half the scale deck length must be provided with the first 10 feet on both ends of the scale being a concrete apron (pad) level with the deck.
- D. Site-Poured Concrete Deck: Refer to the scale manufacturer's instructions and coordinate with the scale manufacturer for products and materials that they will and will not be providing to the Contractor.
- E. The scale modules shall be center supported while pouring the deck.
- F. The scale must be installed level, plumb and in a straight line with itself and the foundation.
- G. The load cell stands, once leveled, must be grouted using a high quality, nonmetallic, non-shrinking-type grout as approved by the scale manufacturer.
- H. The Contractor shall accomplish installation, calibration, and testing under the direction of the scale manufacturer.
- I. Contractor shall have scale certified by the Idaho Weights and Measures

#### **3.2 TESTING / QUALITY CONTROL**

- A. Preoperational Test Phase: Perform factory tests in accordance with manufacturer's requirements. Factory tests shall include factory testing of custom-programmed scale controller and testing of inputs for all input fields.
- B. Component Test Phase: Test scale controller, all interconnected accessories, load cells. RFID reader, kiosk, and software for proper installation. Obtain Idaho Certification of Scale following

check-out of equipment and system. Arrange for registration of the scale in accordance with Idaho requirements. Contractor shall pay all fees for registration.

### 3.3 SERVICE

- A. In addition to the required warrantee, the scale manufacturer shall provide complete service of the scale for a period of 2 years in a manner that keeps the equipment in continuous and legal operation. This shall be accomplished at no additional cost to the Owner.
- B. At a minimum provide two inspections and calibrations per year for the new scales.

### 3.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's original, unopened, undamaged containers.
- B. Handle materials in such a manner as to prevent damage to products or finishes.

**END OF SECTION**

## SECTION 11300

### STATIONARY CRANE

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section. Also refer to the *Geotechnical Engineering Reports* – see Appendix 1 of the Project Manual.

##### 1.2 SUMMARY

- A. This Section includes the Work necessary to furnish and install one electrically powered stationary “knuckle-boom” crane inside the new Waste Transfer Building (WTB) tunnel. The crane manufacturer shall provide the crane, complete, with the frame, boom, base, cab, grapple, electric motor, hydraulic system, controls, anchor bolts, together with all accessories required for proper operation. The crane shall be a Grizzly 215-SW unit as manufactured by Grizzly Crane Company, or equal, and made in the United States of America.
- B. Refer to other Specification sections and Drawings for other elements and features of the crane system to make it fully integrated and “turn-key.” Ensure the power and interfaces are either provided by the crane supplier or the electrical bid portion of the work.
- C. Performance Requirements / Conditions of Service:
  - 1. The crane shall be manufactured and made for the intended purpose of use in loading, distributing, and packing solid waste for a top-load application.
  - 2. The articulated crane will be hydraulically operated, electrically powered, with a solid waste grapple. Crane will be of integral heavy-duty construction, complete with operating accessories customarily furnished with cranes of this type, together with modifications and optional attachments as specified.
  - 3. The crane shall be designed for ease of access for removal and replacement of components for service and adjustment with minimal disturbance to other elements. The cab shall be provided with removable covers on the side of the deck and door in the top of the deck for ready access to parts beneath the cab deck.
- D. Related Sections include the following:
  - 1. Divisions 2, 15, and 16 Sections for mechanical and electrical systems.
- E. In the event Contractor chooses an alternate crane manufacture to what is specified herein, Contractor is required to demonstrate that such will meet or exceed the minimum requirements of the pre-approved Grizzly 215-SW unit. Contractor is also responsible for any and all costs associated with such demonstration and any foundation design changes needed for the alternate crane.



### 1.3 QUALITY ASSURANCE

- A. The manufacturer of the crane shall have been in the business of design and manufacturing of similar type of cranes for at least 10 years. Parts shall be available within 24 hours.

### 1.4 MANUFACTURER'S SERVICES

- A. A manufacturer's representative for the equipment specified shall be present at the Job Site for 1 day for certification of the installation/commissioning, startup assistance. Refer to Section TESTING. Travel time shall not be included in the 1 day at the Job Site. Refer also to Section TRAINING for training requirements.

### 1.5 SUBMITTALS

- A. All materials and products associated with the crane for a complete "turn-key" system.
- B. Manufacturer shall provide documentation pertaining to installation, standard settings, and loading requirements.
- C. Complete detailed shop drawings for the crane, list of conduit requirements, and manufacturer's brochures for the equipment to be furnished.
- D. Complete schematic diagrams and Operating and Maintenance Manuals and Maintenance Summary Sheets with parts lists.
- E. Training Manuals.

### 1.6 WARRANTY

- A. Warranty in writing for the guarantee of the operating performance of the crane and all related equipment and components for a period of 2 years upon certified completion of the entire Contract (but no sooner than Final Completion). In the event of any defect during this period attributable to workmanship under this Contract, make corrective repairs within 5 days of written notice by the Owner so specifying the nature of the defect.

## **PART 2 - PRODUCTS**

### 2.1 GENERAL PERFORMANCE SPECIFICATIONS

- A. The following are minimum requirements for the crane:
  - 1. Compaction / Downforce: 5,000 lbs (minimum at full extension)
  - 2. Operating Pressure: 2,250 psi
  - 3. Lifting Capacity Rating: 21,500 lbs at 8' maximum
  - 4. Overall Boom Length: 25'-1"
  - 5. Grapple: 1/3-cu. yd. solid waste type with wristing cylinder and compacting plate.
  - 6. Hydraulic Pump: Triple, 23/23/18 gpm
  - 7. Electric Motor: 50 HP, 460-v, 3-phase

8. Swing System: Commercial Intertech Druve motor, Fairfield S-3A planetary gear box
9. Swing Speed: Variable to 3 rpm
10. Swing Torque: 6,250 ft-lbs
11. Mast Rotation: Capable of 360-degrees
12. Motor Starter: Combination with 150-amp circuit breaker, based mounted
13. Hydraulic Tank: 125 gallons capacity with low oil level shutoff
14. Hydraulic Oil Cooler: Sized to fit hydraulic system with over pressurization safeguard.
15. Power Control Switch: ON/OFF mounted at controls
16. Tang Gauges: Hydraulic fluid level and temperature.
17. Controls: Dual hydraulic remote controls for main/jib swing and wristing, separate electric rocker switches on hands for grapple orbit and open/close functions.
18. Paint: Two coats (minimum) synthetic enamel

## 2.2 SYSTEM COMPONENTS

- A. Frame and Base: The crane frame and base shall be fabricated of heavy-gauge steel, reinforced, and designed to withstand the maximum stresses normally imposed in solid waste crane operations of this type.
- B. Boom: The crane shall be furnished with a straight articulating boom. The boom shall be of all-welded steel construction, with replaceable bushings. Head, knuckle, and wristing pins shall be a minimum of 2-½" diameter. The head bolt bushing retainer shall be reinforced 1-¾" on each side. The cylinder pin side plates shall be 1" on each side. The knuckle pin boss shall have 1-¼" reinforcement on each side. All pins shall be retained by nuts with a minimum of 2" thread diameter, capable of being locked to the pin to prevent loosening. Boom shall have a minimum of ½" reinforcing plates on both sides
- C. Electric Motor: The crane shall be driven by a minimum of a 50 HP, mill-and-chemical type TEFC motor. Motor shall be rated at 460 volts, 60 Hz, three-phase
- D. The boom shall be connected to the bearing plate by two head ears 1-¼" thick, recessed into the bearing plate. The bearing plate shall be 1-½" thick.
- E. Hydraulic System: The boom and grapple shall be actuated by double-acting hydraulic cylinders with chrome-plated piston rods. The hydraulic pump shall provide ample flow rate (gallons per minute) to meet minimum lift and compaction requirements, as specified. The hydraulic pump shall be designed so that more than two crane functions can be used simultaneously without reducing power to the functions. Ample hydraulic circuit and reservoir capacity shall be furnished for sustained fast operation cycles without overheating. An efficient oil filtering system shall be provided, with filter elements readily accessible for removal and replacement. Hydraulic oil level shall be readily accessible for examination and maintenance. Should the oil level drop below a predetermined level, a sensor shall activate and turn the pump off electrically. Provide the optional tank heater for the colder climate of Northern Idaho.
- F. Swing System: The system shall meet the minimum swing speed requirements. It shall be independent of the main system and capable of 360-degree, non-continuous rotation.
- G. Grapple: The grapple shall be of heavy-duty, all-welded construction and capable of picking and compacting refuse. The minimum volume capacity of the grapple shall be 1/3 cu. yd. Hoses and fittings shall be protected from snagging and breaking. The grapple

shall rotate continuously using a minimum of 20" diameter Rotek, or equivalent, bearing and a pinion on a torque motor that is bolted in place with a minimum of 4 bolts. The grapple shall contain a hydraulic manifold/swivel to allow continuous rotation.

- H. Operator's Cab and Seat: The operator's cab shall allow visibility in all directions for the operator. Glass shall be safety automobile-type glass. The operator's seat shall be adjustable in relation to the controls. The cab will have a 110-volt air conditioning and heating system.

## 2.3 ANCHOR BOLTS

- A. Refer to Structural for the anchor bolt specifications.
- B. Crane manufacturer shall provide the bolts as specified.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. The crane and all appurtenances shall be installed by the Contractor in accordance with the manufacturer's instructions and approved Shop Drawings.
- B. Contractor shall cover painted surfaces with tape or other means during installation to avoid damage to paint surface and to minimize touchup requirements.
- C. Take care in handling and installing the anchor bolts and sandwich plate system. Do not pound, hammer, or bend the bolts in any way.

### 3.2 TESTING

- A. Preoperational Test Phase: Factory tests shall include factory testing of all systems and components.
- B. Component Test Phase: Test crane and all interconnected accessories for function performance.

### 3.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's original, unopened, undamaged containers.
- B. Handle materials in such a manner as to prevent damage to products or finishes.

**END OF SECTION**

## **SECTION 11400**

### **PRE-MANUFACTURED HOUSEHOLD HAZARDOUS WASTE BUILDING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 1 Specification Sections and Special Provisions apply to this Section.

##### **1.2 SUMMARY**

- A. This Section includes the Work necessary to furnish and install one, permanently anchored pre-manufactured hazardous material storage building manufactured by US Chemical Storage at the location shown on the Drawings. The building shall be FM-approved and suitable for the intended purpose of storing combustible, flammables, corrosives, and toxic materials. All material used in construction must be new and designed and constructed specifically for this project. No wood materials are allowed.
- B. Manufacturing quality compliance shall be in accordance with ASTM, AISI, and AWS materials and fabrication standards. The building must also meet all applicable building and fire codes and safety and environmental regulations.
- C. Refer to other Specification sections and Drawings for other elements and features of the Pre-Manufactured HHW Building to make it fully integrated and "turn-key." Ensure the power and interfaces are either provided by the supplier or the electrical bid portion of the work.
- D. Performance Requirements / Conditions of Service:
  - 1. The building shall be manufactured and made for the intended purpose of use in storing and bulking of household hazardous waste (HHW). The building shall only require an electrical service connection to the pre-made load center on the building.
  - 2. The building shall have overall outside dimensions of 38' long by 11'-6" wide by 9'9" tall and be divided into (3) separate bays or rooms for Flammables, Corrosives, and Toxics (in that order). The minimum interior dimensions of each storage area shall be:
    - A. Flammables: 15'-2" long x 9'-8" wide x 7'-2" ceiling height
    - B. Corrosives: 9'-2" long x 9'-8" wide x 7'-2" ceiling height
    - C. Toxics: 9'-2" long x 9'-8" wide x 7'-2" ceiling height

## **SECTION 11400**

### **PRE-MANUFACTURED HOUSEHOLD HAZARDOUS WASTE BUILDING**

3. Climate control, heating and cooling shall be provided within the Flammables and Toxics bays and be capable of maintaining interior temperatures of 50°F to 90°F.
  4. All equipment and systems shall be rated for the intended purpose and conditions and shall come as part of the pre-manufactured system provided by the building manufacturer.
  5. Exterior walls, interior partition walls and roof system shall be insulated and have a 2-hour fire rating.
  6. Although the building will be placed under a canopy, it shall be rated for full exposure to loads and weather conditions.
  7. Individual storage areas shall be ventilated as necessary for each type of stored waste.
  8. The contractor is responsible for coordination of building construction and delivery, and placement with the manufacturer.
  9. Passive venting shall be provided for all storage areas. Mechanical venting shall be provided for the flammable and toxic storage areas.
- E. In the event Contractor chooses an alternate manufacturer to what is specified herein, Contractor is required to demonstrate that such a substitution will meet or exceed the minimum requirements of the pre-approved US Chemical Storage building. Contractor is also responsible for any and all costs associated with such demonstration and any foundation design changes needed for the alternate.

### 1.3 QUALITY ASSURANCE

- A. The manufacturer of the HHW building shall have been in the business of design and manufacturing of similar type of storage buildings for at least 10 years. Any parts shall be available within 24 hours.

### 1.4 SUBMITTALS

- A. Action Submittals:
1. All materials and products associated with the building for a complete “turn-key” system.
  2. Manufacturer shall provide documentation pertaining to installation, standard settings, and any other requirements.
  3. Complete detailed shop drawings for the building certified by a Professional Engineer(s) licensed in the State of Idaho, list of conduit requirements, and manufacturer’s brochures for the equipment to be furnished.
  4. Complete schematic diagrams and Operating and Maintenance Manuals and Maintenance Summary Sheets with parts lists.
  5. Training Manuals.

### 1.5 WARRANTY

- A. Warranty in writing for the guarantee of the operating performance of the building and all related equipment and components for a period of 1 year upon certified completion of

the entire Contract (but no sooner than Final Completion). In the event of any defect during this period attributable to workmanship under this Contract, make corrective repairs within 5 days of written notice by the Owner so specifying the nature of the defect.

## **PART 2 – PRODUCTS**

### **2.1 GENERAL PERFORMANCE SPECIFICATIONS**

- A. The following are minimum requirements for the building:
  - 1. Flammables Storage Capacity: space for eighteen (18) 55-gallon drums with wall mounted two (2) tier shelving on two (2) walls above drums. Shelving to be provided by the building manufacturer.
  - 2. Corrosives Storage Capacity: space for four (4) 55-gallon drums with wall mounted two (2) tier shelving above (2 walls) and one wall with (3) tier shelving. Shelving to be provided by the building manufacturer.
  - 3. Toxics Storage Capacity: space for seven (7) 55-gallon drums with two (2) tier shelving above (2 walls). Shelving to be provided by the building manufacturer
  - 4. Roof Snow Load: 55psf; Floor Live Load: 250psf
  - 5. Building Exterior Color: white
  - 6. Explosion-proof electrical and HVAC components
  - 7. Mandoors to each storage area shall be 2-hour fire rated 60” x 80” double leaf steel door on building front.

### **2.2 SYSTEM COMPONENTS**

- A. Climate control in Flammables and corrosives storage areas.
- B. Galvanized steel, grated floor with spill containment sump.
- C. Dry Chemical fire suppression system with exterior mounted, break glass shut-off button.
- D. Weatherproof, exterior mounted electrical box
- E. Ceiling mounted, explosion proof light fixtures. Minimum of (1) light fixture in each bay.

### **2.3 ANCHOR BOLTS**

- A. Refer to Structural for the anchor bolt specifications.
- B. Building manufacturer shall provide the bolts as specified.

## **PART 3 - EXECUTION**

### **3.1 GENERAL**

- A. The building and all appurtenances shall be installed by the Contractor in accordance with the manufacturer’s instructions and approved Shop Drawings.

- B. Contractor shall cover painted surfaces with tape or other means during installation to avoid damage to paint surface and to minimize touchup requirements. Touchup shall follow manufacturer's instructions using paint and materials supplied by the manufacturer.
- C. Inset building mounting to provide matching finished floor elevation with adjacent concrete slab.
- D. Take care in handling and installing the anchor bolts and base plate system. Do not pound, hammer, or bend the bolts in any way.

### 3.2 TESTING

- A. Preoperational Test Phase: Factory tests shall include testing of all systems and Components prior to leaving the factory.
- B. Component Test Phase: Test building and all interconnected accessories for functional performance.

### 3.3 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store materials in manufacturer's original, unopened, undamaged containers.
- B. Handle materials in such a manner as to prevent damage to products or finishes.

## **END OF SECTION**

# **DIVISION 13**

## **SPECIAL CONSTRUCTION**



## SECTION 13120

### METAL BUILDING SYSTEMS

#### PART 1 - GENERAL

##### 1.1 REFERENCES

- A. The following is a list of standards which may be referenced in this Section:
1. American Architectural Manufacturers' Association (AAMA):
    - a. 101, Standard Specifications for Windows, Doors, and Unit Skylights.
    - b. 605, Voluntary Specification for High Performance Organic Coatings on Architectural Extrusions and Panels.
    - c. 606.1, Voluntary Guide Specifications and Inspection Methods for Integral Color Anodic Finishes for Architectural Aluminum.
  2. American Institute of Steel Construction (AISC):
    - a. 360, Specification for Structural Steel Buildings.
    - b. RCSC Specification for Structural Joints Using ASTM A325 or A490 Bolts.
    - c. Design Guide 3: Serviceability Design Considerations for Steel Buildings.
  3. American Iron and Steel Institute (AISI): Specification for the Design of Cold-Formed Steel Structural Members.
  4. American Welding Society (AWS): D1.1/D1.1M, Structural Welding Code - Steel.
  5. ASTM International (ASTM):
    - a. A36/A36M, Standard Specification for Carbon Structural Steel.
    - b. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
    - c. A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
    - d. A490/A490M, Standard Specification for Structural Bolts, Alloy Steel, Heat-Treated, 150 ksi Minimum Tensile Strength.
    - e. A529/A529M, Standard Specification for High-Strength Carbon- Manganese Steel of Structural Quality.
    - f. A572/A572M, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
    - g. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
    - h. A792/A792M, Standard Specification for Steel Sheet,
    - i. 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process. A992/A992M, Standard Specification for Steel for Structural Shapes.
    - j. C991, Standard Specification for Flexible Fibrous Glass Insulation for Metal Buildings.

- k. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
- l. E96/E96M, Standard Test Methods for Water Vapor Transmission of Materials.
- m. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
- n. E1514, Standard Specification for Structural Standing Seam Steel Roof Panel Systems.
- o. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- 6. International Accreditation Service, Inc. (IAS): Quality Certification Program.
- 7. International Code Council (ICC): International Building Code (IBC).
- 8. Metal Building Manufacturer's Association (MBMA): Metal Building Systems Manual.
- 9. Steel Door Institute (SDI): A250.8, Standard Steel Doors and Frames.
- 10. Underwriters Laboratories Inc. (UL): 580, Tests for Uplift Resistance of Roof Assemblies.

## 1.2 SUMMARY

- A. This section covers pre-engineered metal building construction and incidental custom-designed construction utilizing the same or a similar metal building system.

## 1.3 BUILDING SYSTEM

- A. General. The structural system shall be a clear span rigid steel frame with a shed roof or gable roof per project plans. Any additions or modifications to the foundation, as detailed or specified, which may be required to accommodate construction by the building manufacturer shall be done by and at the expense of the Contractor.
- B. Dimensions. Buildings shall have the nominal dimensions indicated on the Plans. Roofs shall have slopes as shown on the drawing. Exact building dimensions shall be submitted to the Engineer and indicated on the erection drawings provided by the building manufacturer.
- C. Components. All components of the structural system shall be as sized and specified by the metal building manufacturer and consistent with the dimensions on the Drawings. All components shall be clearly marked and referenced on the Drawings. All Drawings shall carry the seal of a professional engineer registered in the State of Montana. All component materials must be manufactured in the United States and meet USDA RD regulations.
- D. Structural Steel Design. All structural mill sections or welded-up plate sections shall be designed in accordance with the latest edition of AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", and all cold-formed steel structural members shall be designed in accordance with the latest edition of AISI "Specification for the Design of Cold-Formed Steel Structural Members".

- E. Design Loading. All building components shall be designed for all superimposed dead loads and governing live loads of the project location. Refer to design criteria on drawing general structural notes.

Loads shall be determined and applied in accordance with the latest edition of the "Uniform Building Code" and the "Metal Building Manufacturer's Association" design practices.

- F. Foundation and Pilaster Design.  
The Contractor shall verify that the foundation walls and pilasters shown are large enough for connection of the building structural members with proper bearing. The sizes of foundations, frame ties and pilasters shall be adjusted as approved based on the results of these evaluations to provide compact and economical structural sections. The calculations, along with required anchor bolt design and any revised foundation and pilaster sections, shall bear the seal of a Professional Engineer registered in the State of Montana, and shall be furnished as part of the submittals. The Contractor shall incorporate into the work all changes to foundation and pilaster sizes recommended without additional cost to the Owner.
- G. Bay Spacing. Spacing between primary framing members are indicated on the Drawings and shall not be modified without the approval of the project engineer.

#### 1.4 SUBMITTALS

- A. Action Submittals:
1. Shop Drawings:
    - a. Manufacturer's literature and technical data.
    - b. Drawings Stamped by Building Manufacturer's Engineer:
      - 1) Drawings shall be specifically prepared for this Project.
      - 2) Mark out details that do not apply to Project.
      - 3) Show design load criteria, material specifications for framing members and connections, roof framing plan with dimensions and member sizes, baseplate details showing anchor bolt size and bolt layout, elevations of wall framing and bracing, instructions for temporary bracing, framing around roof and wall openings, details for joining and sealing of roof panels and wall cladding, and sections and details for all components and accessories.
    - c. Drawings stamped by Contractor's engineer registered in the State of Montana for complete anchor bolt design at each column location. Design shall include, but is not limited to, concrete anchor reinforcements, anchor bolt diameter, number of anchor bolts required, anchor bolt layout, location, material, threaded projection, concrete edge distances and embedment length at each column connection. Coordinate with the metal building system manufacturer for the anchor bolt reactions, anchor bolt diameter and layout as required and maintain all critical dimensions noted on Drawings. Alternatively, the building manufacturer may provide the complete anchor bolt design; however, the Contractor shall coordinate with the building manufacturer to ensure that the building manufacturer can provide a complete anchor bolt design.
    - d. Painting System: Specifications; include paint manufacturer's name, product trade name, and preparation for shop and field coats.
  2. Samples: Minimum 2-inch by 3-inch metal for components requiring color

selection.

- B. Informational Submittals:
  - 1. Structural Calculations Stamped by Engineer:
    - a. Complete analysis and design of structural components and connections in accordance with design requirements indicated.
    - b. Summary of building column reactions to foundation level for load cases.
    - c. Mark out calculations that do not apply to Project.
  - 2. Manufacturer's written instructions for shipping, handling, storage, protection, and erection or installation of building and components.
  - 3. Manufacturer: IAS Quality Certification: IAS certificate showing name and address of manufacturer, effective date, and category of certification.
  - 4. Erector:
    - a. IAS Quality Certification: IAS certificate showing name and address of erector, effective date, and category of certification, or, in lieu of IAS certification, documentation of past 5 years' experience record to include project name, location, date of completion, building manufacturer, and name and phone number of Owner's contact person.
    - b. Certification of approval by manufacturer.
  - 5. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

## 1.5 QUALITY ASSURANCE

- A. Qualifications:
  - 1. Designer: Registered professional engineer valid in same state as Project.
  - 2. Manufacturer: IAS Quality Certification: Metal Building Systems (MB).
  - 3. Erector:
    - a. IAS Quality Certification as Certified Steel Erector (CSE), or 5 years of experience in erection of metal building systems in lieu of IAS certification.
    - b. Approval by manufacturer.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect building components and accessories from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Deliver to Site with parts individually tagged.
- C. Store on wood blocking or pallets, flat and off ground, to keep clean and to prevent damage or permanent distortion. Support bundles so there is no danger of tipping, sliding, rolling, shifting, or material damage. Cover with tarpaulins or other suitable weathertight ventilated covering.
- D. Protect finish of metal panels by application of removable plastic film or other suitable material placed between panels. Do not allow panels to come in contact with other material that would result in scratching, denting, staining or other damage to panel finish.

## 1.7 SPECIAL GUARANTEE

- A. Furnish manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of Owner, removal and replacement of Work specified in this Section found defective during a minimum period of 5 years and as stated below after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.
- B. Conditions:
  - 1. Finish on metal roof, wall panels, flashing, and trim will not chalk, crack, check, blister, peel, flake, chip, or lose adhesion for 5 years. Roofing will remain weathertight for 20 years.

## 1.8 SPARE PARTS

- A. Two standard full-length undamaged wall, and roof panels of each type and color used shall be provided along with adequate fasteners and accessories for their installation.

## PART 2 - PRODUCTS

### 2.1 BUILDING SYSTEM MANUFACTURERS

- A. Products manufactured or supplied by the following, and meeting these Specifications, may be used on this Project:
  - 1. Butler Manufacturing Co, Kansas City, MO.
  - 2. Star Building Systems, a Robertson Ceko Co., Oklahoma City, OK.
  - 3. Varco-Pruden Buildings, Memphis, TN.
  - 4. Pacific Bouilding Systems, Woodburn, OR.
  - 5. NuCor,
  - 6. Con Am
  - 7. Northern Building Supply, Missoula, MT
  - 8. Or equal

### 2.2 COMPONENTS

- A. Structural Framing and Bracing:
  - 1. Primary Framing: ASTM A36/A36M, ASTM A529/A529M, ASTM A572/A572M, or ASTM A992 with 3/16-inch minimum thickness and factory primer compatible with finish coating.
  - 2. Secondary Framing: Steel for cold-formed galvanized channel and
  - 3. z-sections shall be ASTM A653/A653M, Structural Steel (SS) Grade 33 or High-Strength Low-Alloy Steel (HSLAS) Grade 50 Type A or B, with G60 galvanized coating and minimum design thickness equal to 0.0346 inch.
  - 4. Bracing:
    - a. ASTM A36/A36M or ASTM F1554, Grade 36, for threaded rod, or ASTM A36/A36M for rolled shapes.

- b. Do not use wire rope or cable for permanent bracing.
  - 5. Bolted Connections:
    - a. Primary Framing: ASTM A325 or ASTM A490/A490M high- strength bolted connections.
    - b. Secondary Framing: ASTM A307 or ASTM A325.
- B. Roof and Wall Panels:
  - 1. Material:
    - a. ASTM A653/A653M or ASTM A792/A792M preformed ribbed steel panels, Grade 50, minimum.
    - b. Minimum 24-gauge galvanized steel with roll-formed corrugations for structural stiffness and appearance.
    - c. Finish: Factory-applied baked enamel, in color selected by Engineer.
    - d. Translucent FRP Wall Panels:
      - 1) Corrugations to match wall panels.
      - 2) Manufacturers:
        - Resolite Corporation.
        - Equal
  - 2. Roof Panel System:
    - a. ASTM E1514 structural standing seam steel roof panel system.
    - b. Panels shall be one piece from eave to ridge, with concealed clips and fasteners to purlins to allow for thermal movement over
    - c. 120-degree ambient temperature range.
    - d. Sidelap joints shall be made with a factory caulked, mechanically seamed cleat.
    - e. Tested and certified to meet UL 580, Class 90 wind uplift rating.
  - 3. Wall Panel System:
    - a. One piece from eave to sill, with base trim at sill.
    - b. Sidelaps: Overlapping major ribs with exposed color-matched fasteners.
    - c. Translucent Panel: Clear translucent with C/W Barrier coating. Locations as shown on Drawings.
  - 4. Wall Liner Panels:
    - a. One piece, height as shown on Drawings.
    - b. Sidelaps: Overlapping major ribs with exposed color-matched fasteners.

## 2.3 ACCESSORIES

- A. Trim: Factory-formed and factory-painted ridge cap, rake trim, simple eave trim, panel side trim, corner trim, door trim, and other trim as necessary.
- B. Gutter Fascia and Downspouts:
  - 1. Material: ASTM A653/A653M, 24-gauge galvanized steel.
  - 2. Gutter Fascia:
    - a. Prefinish.
    - b. Furnish hangers with factory-applied paint.
  - 3. Preformed Corner Closures: Furnish to match configuration of gable fascia.
  - 4. Downspouts:
    - a. Configuration: Nominal 6-inch corrugated rectangular box.
    - b. Factory finish to match wall panels.

- C. Miscellaneous: Furnish fasteners, metal-backed neoprene washers, weatherstripping, sealants, roof jacks, roof curbs, gaskets, and other items as required for a complete installation.

## 2.4 FABRICATION

- A. Factory Fabricate: To manufacturer's written standards, MBMA Metal Building Systems Manual, and AISC Specification for Structural Steel Buildings.
- B. Building Parts: Accurate and true to dimension to facilitate building erection without cutting, fitting, or other alterations.
- C. Welded Connections: In accordance with AWS D1.1/D1.1M.
- D. Shop Primer for Primary Framing:
  - 1. Surface Preparation and Primer: As specified per manufacturer.

## 2.5 FRAME TIES

- A. Frame ties shall be as required by foundation design. Frame ties shall be indicated on submittal drawings.

## 2.6 FASTENERS

- A. Structural fasteners shall be high-strength steel bolts and nuts with washers sized in accordance with manufacturer's structural requirements. All exposed fasteners shall have EPDM rubber washers.
- B. Panel-to-structural connections shall be made with self-tapping, case hardened steel fasteners with steel-backed neoprene washers. Panel-to-panel connections shall be made with self-tapping, No. 14 min. Type A-B screws. Fasteners shall be zinc coated. Wall fasteners shall be painted or capped to match the wall color.

## 2.7 EAVE & GABLE TRIM

- A. Eave and gable trim shall be fabricated of minimum 24-gauge, galvanized steel and shall meet requirements specified for roof panels. Closures shall be precise and preformed to match the configuration of the eave and gable trim. Preformed weatherseals shall be installed to completely fill roof panel corrugations prior to the installation of eave trim. The finished roof structure shall be weathertight and sealed to prevent infiltration. Eave profiles shall incorporate a gutter system connected to downspouts as required.

# PART 3 - EXECUTION

## 3.1 GENERAL

- A. General. Erection of metal building systems shall be performed by manufacturer-trained crews with no less than five years' experience in erecting similar metal buildings.
- B. Welding. Welding procedures, operator qualifications and welding quality standards shall be in accordance with the American Welding Society's structural welding code.

### 3.2 BUILDING ERECTION

- A. Erect building system in accordance with manufacturer's standards and instructions.
- B. Provide temporary bracing in accordance with MBMA standards and as required for safe installation.
- C. Structural Framing:
  - 1. Do not field cut or alter primary or secondary framing members.
  - 2. Installation and tolerances shall be in accordance with MBMA Metal Building Systems Manual.
- D. Roof and Wall Panels:
  - 1. Field cutting of panels by torch is not permitted.
  - 2. Attach panels to structural supports to maintain a weathertight seal while allowing for thermal and structural movement.
    - a. Install exposed fasteners in true vertical and horizontal alignment.
    - b. Field seam side laps of standing seam roof panels using electrically operated seaming machine.
    - c. Use proper tools to install screw fasteners to compress neoprene washer without damaging washer or stripping metal.
  - 3. Install manufacturer's standard joint sealants, gaskets, and closure strips as required for weathertight installation.
  - 4. Install roof curbs for rooftop equipment.
  - 5. Field Cutting and Patching: Perform in manner not to impair appearance, weathertightness, or structural capacity of panel system.
  - 6. Openings for pipes, vents, and other accessories shall be positively moisture sealed with approved roof jacks, flashing and accessories.

### 3.3 REPAIR, CLEANING, AND PAINTING

- A. Immediately following erection, remove unused material, screws, fasteners, and other debris from completed installation. Use caution in removing metal cuttings from surface of prefinished metal panels.
- B. Replace damaged, dented, buckled, or discolored metal panels.
- C. Repair damaged painted and galvanized surfaces as specified in Section 09900, Painting and Coating.
- D. Finish Painting: per manufacturer



3.4 TRIM

- A. All trim pieces shall be securely attached and water- and weather sealed.

3.5 MANUFACTURER'S SERVICES

- A. Provide manufacturer's representatives at site for installation assistance, inspection, and certification of proper installation.

**END OF SECTION**

# **DIVISION 15**

## **MECHANICAL**

## DIVISION 15 – MECHANICAL INDEX

15000	General Provisions
15050	Basic Materials and Methods
15055	Motors
15060	Hangers & Supports
15075	Mechanical Identification
15080	Mechanical Insulation
15140	Domestic Water Piping
15145	Domestic Water Piping Specialties
15150	Sanitary Waste and Vent Piping
15155	Sanitary Waste Piping Specialties
15412	Emergency Plumbing Fixtures
15441	Plumbing Pumps
15485	Electric Water Heaters
15543	Waste-Oil-Fired Heaters
15550	Breechings, Chimneys, and Stacks
15762	Unit Heaters
15815	Metal Duct
15838	Power Ventilators
15900	Controls and Instrumentation
15950	Testing, Adjusting and Balancing

END OF INDEX

The technical specification sections listed above have been prepared under the direction of the Professional Engineer, registered in the State of Idaho, whose seal and signature appear below:



## SECTION 15000

### GENERAL PROVISIONS

#### PART 1 - GENERAL

##### 1.1 CONDITIONS AND REQUIREMENTS

- A. Refer to BIDDING REQUIREMENTS, CONDITIONS OF THE CONTRACT, SUPPLEMENTARY CONDITIONS and DIVISION 1 of these specifications, which govern work under DIVISION 15. Refer to other sections of these specifications for additional related requirements.

##### 1.2 SCOPE OF REQUIREMENTS

- A. The work covered by Division 15 of the specifications shall include but not be limited to:
  - 1. Furnishing all materials and supplying all labor, equipment and services to install the complete mechanical system as shown on the accompanied drawings and specified herein.

##### 1.3 DESCRIPTION OF WORK

- A. The contract documents including specifications and construction drawings are intended to provide all material and labor to install complete plumbing, heating ventilating and air conditioning systems for the building.
- B. Every effort has been made on the design to meet or exceed the minimum requirements of the Codes; therefore, unless Contractor before signing his Contract, shall have notified the Architect, in writing, of any items in conflict with said Codes, he shall thereafter make any minor adjustments necessary to meet said Codes at no cost to the Owner.
- C. The Contractor shall refer to the architectural interior detail, floor plans, elevations, and the structural and other Contract Drawings and he shall coordinate his work with that of the other trades to avoid interference. The plans are diagrammatic and show generally the locations of the fixtures, equipment, and pipe lines and are not to be scaled, all dimensions shall be checked at the building.
- D. The Contractor shall comply with the project close-out requirements as detailed in General Requirements of Division 1.

##### 1.4 DESCRIPTION OF BID DOCUMENTS

- A. Specifications:
  - 1. Specifications, in general, describe quality and character of materials and equipment.
  - 2. Specifications are of simplified form and include incomplete sentences.
- B. Drawings:
  - 1. Drawings in general are diagrammatic and indicate sizes, locations, connections to equipment and methods of installation.
  - 2. Scaled and figured dimensions are approximate and are for estimating purposes only.

3. Before proceeding with work check and verify all dimensions.
4. Assume all responsibility for fitting of materials and equipment to other parts of equipment and structure.
5. Make adjustments that may be necessary or requested in order to resolve space problems, preserve headroom, and avoid architectural openings, structural members and work of other trades.
6. If any part of Specifications or Drawings appears unclear or contradictory, apply to Architect or Engineer for his interpretation and decision as early as possible.

#### 1.5 CODES PERMITS AND FEES

- A. Mechanical work shall be in accordance with the following:
  1. The latest edition of the International Building Code, International Mechanical Code, Uniform Plumbing Code, International Fire Code, National Electric Code, American Disability Act and all applicable State and Local Codes and Ordinances.
  2. The Contractor at his expense shall obtain permits and inspections required for the mechanical work on this project. Deliver all inspection certificates to the Owner's Representative prior to final acceptance of the work.
  3. Contractor shall pay all costs levied by utility companies and/or governing agencies associated with water, gas, sanitary and storm sewer connections and include these costs within his bid. This shall include but not be limited to tap fees, service mains, meter and vault charges.

#### 1.6 DEFINITIONS

- A. The terms "The Contractor", when used in Division 15 shall mean the Contractor for mechanical work.
- B. The term "Owners Representative" as used in Division 15 generally refers to the Architect or his designated representative in accordance with the General Conditions.
- C. The term "Provide" shall mean furnish and install.

#### 1.7 TEMPORARY HEATING

- A. Temporary heating for the facility during the construction phase shall not be supplied by the permanent system installed under Division 15.

#### 1.8 SAFETY AND PROTECTION

- A. Safety Measures: The Engineer has not been retained to provide design and construction services relating to the Contractor's safety precautions, or means, methods, techniques, sequences or procedures required for the Contractor to perform his work. The Contractor shall be solely and completely responsible for conditions of the job site, including safety of all persons and property during performance of the work. This requirement applies continuously and is not limited to normal working hours. Provide all required safety measures and consult with the State or Federal safety inspector for interpretation whenever in doubt as to whether safe conditions do or do not exist or whether compliance with State or Federal regulations exist.

- B. Head protection: Where pipe hangers, equipment support angles, etc., are exposed in access ways for any maintenance, cover all such potentially injurious protrusions less than 7'-0" above the floor with padding; secure and permanently fasten, and finish to match adjacent finishes.

#### 1.9 MECHANICAL COST BREAKDOWN

- A. The Contractor shall furnish the Owner's Representative an itemized breakdown of the mechanical construction cost within 30 days of notice to proceed.

### PART 2 - PRODUCTS

#### 2.1 DUCTWORK AND PIPING COORDINATION

- A. Prior to installation of the new division 15 systems, the Contractor shall coordinate the proposed installation with the Architectural and Structural requirements, and all other trades (including HVAC, Plumbing, Fire Protection, Electrical, Ceiling Suspension and Tile systems), and provide reasonable maintenance access requirements.
- B. Provide means of access to all valves, dampers, controllers, operable devices and other apparatus which may require adjustment or servicing.
- C. Verify in field exact size, location, invert, and clearances regarding all existing material, equipment and apparatus, and advise the Owners Representative of any discrepancies between that indicated on the Drawings and that existing in the field prior to any installation. Contractor shall be responsible for all costs associated with the removal or relocation of installed systems that have been installed without prior notification of the Owners Representative.

#### 2.2 EQUIPMENT AND MATERIALS – STANDARDS/CODES

- A. Materials used under this Contract, unless specifically noted otherwise, shall be new and of the latest and most current model line produced by the manufacturer. Each item of equipment shall conform to the latest Standard Specifications of the American Society for Testing Materials and shall conform to any applicable standards of the United States Department of Commerce.
- B. Instruct the Owners representative(s) in operation and maintenance of mechanical systems utilizing the Operation and Maintenance Manual. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when the Project is turned over to the Owner.
- C. All electrically driven or connected equipment shall be provided with UL or equivalent label and/or listing in accordance with the requirements of the NEC.
- D. All control panels shall be provided with UL or equivalent Label and/or listing in accordance with the requirements of the NEC and applicable local codes.
- E. Fuel fired equipment shall be listed by a nationally recognized testing laboratory for use with the fuel type.
- F. All pressure vessels and relief valves shall be furnished in accordance with applicable State Boiler and Unfired Pressure Vessel Laws.

## 2.3 EQUIPMENT PROTECTION AND CLEAN-UP

- A. Protect equipment and materials in storage on site, during and after installation until final acceptance. Leave factory covers in place and take special precautions to prevent entry of foreign material into working parts of piping and duct systems.
- B. Protect equipment with polyethylene covers and crates.
- C. Operate, drain and flush bearings and refill with change of lubricant before final acceptance.
- D. Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Provide extended nipples for lubrication.
- E. Ensure that existing equipment is carefully dismantled and not damaged or lost. Do not re-use existing materials and equipment unless specifically indicated.
- F. During construction, provide temporary closures of metal or taped polyethylene at all openings in new ductwork to prevent construction dust from entering existing ductwork system. Prior to installation ductwork shall be stored in a clean dry location and protected from foreign material from entering the duct. Ductwork that has been contaminated shall be cleaned before being installed. Lined ductwork that has been contaminated shall be discarded and new lined ductwork shall be installed.
- G. Remove stickers from fixtures and adjust flush valves.

## PART 3 - EXECUTION

### 3.1 LOCATIONS

- A. Coordination of Division 15 equipment and systems to the available space, with other trades. The access routes through the construction shall be the Contractor's responsibility.
- B. Drawings are diagrammatic. Make offsets, transitions, and changes in direction of pipes and ducts, as required to maintain proper headroom and pitch of sloping lines and avoid structural, electrical, pipe and duct interference's whether indicated on Drawings. Furnish fittings, etc., as required to make these offsets, transitions and changes in direction at no additional cost to the Owner.
- C. Determine exact route and location of each pipe and duct and coordinate and obtain approval for changes from the layout indicated on the drawings with the Owner's Representative prior to fabrication.
- D. Locations of equipment and devices, as shown on the drawings, are approximate unless dimensioned. Verify the physical dimensions of each item of mechanical equipment to fit the available space and promptly notify the Owner's Representative prior to roughing-in if conflicts appear.
- E. All piping, wiring, equipment, ductwork, tubing, etc., shall be concealed within building construction unless otherwise noted, or in mechanical rooms.

- F. Arrange pipes, ducts, and equipment to permit ready access to valves, unions, traps, trap primers, starters, motors, control components, and to clear openings of doors and access panels.

### 3.2 CUTTING AND PATCHING

- A. All cutting and patching of new and existing construction required for the installation of systems and equipment specified in Division 15 shall be the responsibility of the Division 15 Contractor. All cutting shall be accomplished with masonry saws, drills or similar equipment to provide neat uniform openings.
- B. Patch and repair walls, floors, ceilings and roof with materials of same quality and appearance as adjacent surfaces unless otherwise shown. Surface finishes shall exactly match existing finishes of same materials. All patching shall meet the approval of the Owner's Representative.
- C. All cutting and patching made necessary to repair defective equipment, defective workmanship or be neglect of this Contractor to properly anticipate his requirements shall be included in Division 15.
- D. Cut carefully to minimize necessity for repairs to existing work. Do not cut beams, columns, or trusses or other structural members without the Owner Representative's written approval.
- E. Cutting, patching, repairing, and replacing pavement, sidewalks, roads, and curbs to permit installation of work specified or indicated under this Division is responsibility of Division 15.

### 3.3 SCHEDULING

- A. It is understood that while drawings are to be followed as closely as circumstances permit, the Contractor shall be responsible for installation of systems according to the true intent and meaning of Contract Documents. Anything not clear or in conflict will be explained by making application to Owner's Representative. Should conditions arise where certain changes would be advisable, secure approval from Owner's Representative for those changes before proceeding with work.
- B. Coordinate with the work of various trades when installing interrelated work. Before installation of mechanical items, make proper provision to avoid interferences. Changes required in work specified in Division 15 caused by neglect to do so shall be made at no cost to Owner.
- C. Furnish and install inserts and supports required by Division 15 unless otherwise noted. Furnish sleeves, inserts, supports, and equipment that are an integral part of other Divisions of the Work to those involved in sufficient time to be built into construction as the Work proceeds. Locate these items and see that they are properly installed. Expense resulting from improper location or installation of items above shall be borne under Division 15.

### 3.4 EXISTING UTILITIES AND PIPING

- A. The locations of existing concealed lines and connection points have been indicated as closely as possible from available information. The Contractor shall assume that such connection points are within a Ten-foot (10') radius of the indicated location. Where



connection points are not within this radius, the Contractor shall contact the Owner's Representative for a decision before proceeding or may proceed at his own expense.

- B. Connection points to existing work shall be located and verified prior to starting new work.
- C. Prior to commencing any excavation or ditching activity, the Contractor shall verify the exact location and inverts of all existing utilities and connection points in the area of his proposed excavation. Notify Owner's representative for further direction if actual inverts will not allow the proper installation of new work.
- D. The Contractor shall be responsible for damages, which might be caused by his failure to exactly locate and preserve underground utilities.

### 3.5 PHASING AND SEQUENCE OF WORK

- A. Contractor shall be aware that this is a phased project. There will be occupied areas adjacent to construction areas that must remain operable.
- B. Work shall be bid to allow for the phased nature of this project and the adjacent occupied areas.
- C. All systems shall be fully operational to the extent that they are installed at the termination of each phase of the work.
- D. System passing through existing, future, or other phase areas shall be installed, if required, to make work installed under the current phase operational.
- E. All connections to and disconnections from existing utilities such as steam and temperature control systems shall be coordinated with and approved by the Owner prior to proceeding with the work. Work shall be planned to minimize impact to areas not involved in ongoing construction. Where areas not involved in ongoing construction are to be impacted, the contractor shall identify such areas, the extent to which they will be affected and the period of time for which they will be affected. All new and relocated piping shall be installed, cleaned and tested prior to making connection to existing systems. Provide required temporary mechanical connections to accommodate the nature of this work.
- F. The contractor is advised that the above notification and scheduling requirement may necessitate rescheduling, partial completion and reconnection, overtime work at night or on weekends or delay of the work. Contractor costs incurred due to the above shall be included in the original bid price and shall not be the cause for additional claims or charges to the Owner.

### 3.6 ASBESTOS CONTROL

- A. Specific attention is directed to the potential of asbestos bearing compounds and materials on the project. Careful coordination with other Contractors and reasonable care shall be exercised.
  - 1. Extent of Asbestos:
    - a) It can be assumed that the Owner will have removed all asbestos from the construction area of this project prior to this contract.

2. If asbestos bearing or other hazardous compounds are encountered during the course of construction, the Contractor shall immediately notify the Owner who will take appropriate action to have the asbestos removed.

### 3.7 TESTS

- A. Piping and duct systems shall be subject to tests as specified below. No piping shall be covered or concealed until it has been tested, inspected and approved by the Owner's Representative and any local inspector having jurisdiction. Isolate systems during testing and flushing. Equipment items with maximum working pressure of less than the test pressure shall be removed or bypassed during test.
- B. A record similar to the following shall be kept recording each test and copies shall be sent to the Owner's Representative after each test is complete.

OWNER'S REPRESENTATIVE OR LOCAL INSPECTOR:

SYSTEM TESTED	TESTED BY	INSPECTOR	DATE
Domestic Hot Water Piping	_____	_____	_____
<b>Domestic Cold Water Piping</b>	_____	_____	_____
<b>Waste and Vent Piping</b>	_____	_____	_____

- C. Provide all test equipment, including test pumps, gauges, instruments, and other equipment required. Test all rotational equipment for proper direction of rotation. Upon completion of testing, certify to the Architect, in writing that the specified tests have been performed and that the installation complies with the specified requirements.
- D. Piping (Process Piping Excluded): Remove from the system during testing, all equipment which would be damaged by test pressure. Replace removed equipment when testing has been accomplished. The systems may be tested in sections as the work progresses; however, any previously tested portion shall become a part of any latter test of a composite system. Correct leaks by remaking joints with new material.
- E. Test time will be accrued only while full test pressure in on the system, unless indicated otherwise. Tolerance shall be no pressure drop, except that due to temperature change in a 24-hour period. Inspect and test all work prior to burying or concealing.

<u>System</u>	<u>Test Medium</u>	<u>Test Pressure</u>	<u>Tolerance-Test Period</u>
<b>Domestic Water</b>	<b>Water</b>	<b>175 psig</b>	<b>None – 8 Hours</b>
Waste	Water	10 feet head, 5 psi	No Leaks – 8 Hours
Vent	Water	Top of Vent Terminal	No Leaks – 8 Hours

- F. Final Drainage, Waste and Vent Test: Upon project close-out, Contractor shall perform and certify that the DWV (Process Piping Excluded) system has passed the following test:
  1. After all plumbing fixtures have been installed and their traps filled with water, all vent terminals and building drains shall be closed and a U-tube manometer shall be inserted into the trap of a water closet and an air compressor testing apparatus shall be attached to any suitable opening. An air pressure of 1" water column as indicated on the manometer shall be introduced into the system. The

pressure shall hold constant for a period of 15 minutes without the introduction of additional air. Leaks revealed during this test may be located by smoke test or other recognition methods.

- G. Valves: Test all valve bonnets for tightness. Test operate all valves at least once from closed-to-open-to-closed position while valve is under test pressure. Test all automatic valves, including solenoid valves, and temperature and pressure relief valves, safety valves, and temperature and pressure relief valves not less than three (3) times.
- H. Refrigeration Piping: Prior to initial operation, clean and test refrigerant piping in accordance with ANSI B31.5 "Refrigeration Piping". Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27 inch vacuum, and replace refrigerant piping as required to eliminate leaks, and retest as specified to eliminate leaks, and retest as specified to demonstrate compliance.
- I. Piping Specialties: Test all thermometers, pressure gauges, and water meters for accurate indication; automatic water feeders, air vents, trap primers, and vacuum breakers for proper performance. Test all air vent points to ensure that all air has been vented.
- J. Ductwork: Test all air quantities as specified in Section 15990 "Testing Adjusting and Balancing". Provide pressure testing for all medium pressure ductwork per the requirements of the HVAC Air Duct Leakage Test Manual as published by SMACNA. Medium pressure ductwork shall be pressure tested to 6" Positive or Negative inches wg.
- K. Registers and Diffusers: Test for proper operation of manually operated control feature. Test all air quantities as specified in Section 15990 "Testing Adjusting and Balancing".
- L. Ductwork Specialties: Test all operable ductwork specialties for proper operation. Check all fire and fire/smoke dampers to ensure they are 100% open.
- M. Temperature Control: Test all control functions to assure that all systems are controlling as specified or as otherwise necessary and that all controls are adjusted to maintain proper room temperatures. The manufacturers representative shall perform all tests.
- N. Backflow Preventers: Each testable backflow prevention device shall be tested and approved by certified testers after installation. Submit test results.
- O. Demonstrate that the total mechanical systems are performing to provide conditions through all possible modes of operation as outlined below. The verification testing procedures shall address all operating characteristics of all mechanical equipment and systems, including:
  - 1. Air Handling Units: Testing will include sequences of pumps and related components under various conditions such as start-up, shutdown, load changes, outdoor air temperature reset, alarms and lockouts. Also included will be variable frequency drive control, operation of dampers in all modes, operation of coil control valves, heat recovery operation and life safety operation.
  - 2. Terminal Units: Testing will include damper and heating water valve sequences during heating, cooling, deadbands, occupied and unoccupied mode and verification of space setpoint temperatures.

3. Domestic Hot Water System: Testing will include sequence of heater, pumps and mixing valve including startup, shutdown, manual modes and power failure.
4. Fan Coil Units: Testing will include operation of dampers in all modes and operation of coil control valves.
5. HVAC Controls: Testing will include aspects described above for various equipment and systems under DDC control. Additional testing will involve system features such as monitoring and setpoint capabilities. See Control Diagrams.

### 3.8 SYSTEM CLEANING AND FLUSHING

- A. The following piping systems shall be flushed, cleaned, disinfected, etc. by a recognized professional firm engaged in the business of pipe cleaning and water treatment. Work shall be accomplished in accordance with the following requirements. Work shall be fully documented by means of certificates stating work accomplished, methods used and date work was done. System cleaning and flushing shall be done by Inland Aqua Tech, King Total Systems, or approved equal.
  1. Domestic Water (Inside Foundation Perimeter)
    - a) Disinfect water mains and water service piping, in accordance with AWWA C 601.
    - b) Domestic water lines shall be chlorinated by injecting chlorine at the entrance main (where new waterline connects to existing main outside the building) and maintaining 100 PPM concentration at every plumbing fixture for a 24-hour period. Flush until chlorine level is same as incoming water. Water samples shall be submitted and approved by the Spokane Co. health authority prior to acceptance and occupancy by the Owner. Approval by the A/E is conditional on receipt of documentation. Note: water samples shall be taken at appropriate locations throughout the building to assure complete sampling of all domestic water systems.
    - c) Domestic water heater shall be chlorinated in the same manner as the domestic water piping, and maintaining 100 PPM concentration for a 24-hour period. Flush until chlorine level is same as incoming water. Water samples shall be submitted and approved by the Spokane Co. health authority prior to acceptance and occupancy by the Owner. Approval by the A/E is conditional on receipt of documentation.

### 3.9 PROJECT FINALIZATION & STARTUP

- A. Upon completion of the equipment and systems installation and connections, the Contractor shall assemble all major equipment factory representatives (Air Handling Units) and subcontractors together for system start-up and Owner instructional period.
- B. These individuals shall assist in start-up and check out of their systems and shall remain at the site until the system operation is acceptable and understood to the Owner's maintenance and/or operation personnel.
- C. To provide acceptance of operation and instruction by the Owner's representative, the Contractor shall prepare a written statement of acceptance explaining same for the Owner's signature.

The statement should read as follows:

"I, the Contractor, associated factory representative and subcontractor, have started each system and the total system and have proved their normal operation to the Owner's representative and have instructed him in the operation and maintenance thereof."

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Owner's Representative

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Contractor

- D. Copies of this acceptance shall be sent to the Engineer and the Architect and one copy shall be put in each maintenance manual.

### 3.10 PUNCH LIST PROCEDURES

- A. The Contractor shall notify the Owner's Representative in writing when the project is ready for punch lists. After punch lists are complete, written notice must be forwarded to the Owner's Representative requesting final checkout.
- B. At the time of final observation, the project foreman shall accompany the observation party and shall remove access panels as required, to allow complete observation of the entire mechanical system.

**END OF SECTION 15000**

## SECTION 15050

### BASIC MECHANICAL MATERIALS AND METHODS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following:
  - 1. Piping materials and installation instructions common to most piping systems.
  - 2. Dielectric fittings.
  - 3. Mechanical sleeve seals.
  - 4. Sleeves.
  - 5. Escutcheons.
  - 6. Grout.
  - 7. Equipment installation requirements common to equipment sections.
  - 8. Concrete bases.
  - 9. Supports and anchorages.

##### 1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

##### 1.3 SUBMITTALS

- A. Welding certificates.

#### 1.4 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
  - 1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
  - 2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

### PART 2 - PRODUCTS

#### 2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

#### 2.2 JOINING MATERIALS

- A. Refer to individual Division 15 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.
- G. Solvent Cements for Joining Plastic Piping:
  - 1. ABS Piping: ASTM D 2235.
  - 2. CPVC Piping: ASTM F 493.
  - 3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

4. PVC to ABS Piping Transition: ASTM D 3138.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F .
- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Stainless steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
  - 1. Underdeck Clamp: Clamping ring with set screws.



- E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.
- F. PVC Pipe: ASTM D 1785, Schedule 40.
- G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

## 2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
  - 1. Finish: Polished chrome-plated.
- D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.
  - 1. Finish: Polished chrome-plated.

## 2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
  - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
  - 2. Design Mix: 5000-psi, 28-day compressive strength.
  - 3. Packaging: Premixed and factory packaged.

# PART 3 - EXECUTION

## 3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

- D. All piping routed inside of walls exposed to the exterior or unconditioned spaces, shall be installed on the warm side of the insulation.
- E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Install piping to permit valve servicing.
- H. Install piping at indicated slopes.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Install piping to allow application of insulation.
- L. Select system components with pressure rating equal to or greater than system operating pressure.
- M. Install escutcheons for penetrations of walls, ceilings, and floors.
- N. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- O. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Install steel pipe for sleeves smaller than 6 inches in diameter.
  - 2. Install cast-iron "wall pipes" for sleeves 6 inches and larger in diameter.
  - 3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.
- P. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
  - 1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

- Q. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- R. Verify final equipment locations for roughing-in.
- S. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

### 3.2 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.
- F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
  - 1. Comply with ASTM F 402, for safe-handling practice of cleaners, primers, and solvent cements.
  - 2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
  - 3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.

4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
  5. PVC Nonpressure Piping: Join according to ASTM D 2855.
  6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.
- J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.
- K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
  2. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

### 3.3 PIPING CONNECTIONS

- A. Make connections according to the following, unless otherwise indicated:
1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
  2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
  3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
  4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

### 3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

### 3.5 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.
  - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
  - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of the base.
  - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
  - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
  - 7. Use 3000-psi , 28-day compressive-strength concrete and reinforcement as specified in Division 3 .

### 3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGES

- A. Refer to Division 5 Section "Metal Fabrications" for structural steel.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
- C. Field Welding: Comply with AWS D1.1.

### 3.7 GROUTING

- A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.
- B. Clean surfaces that will come into contact with grout.
- C. Provide forms as required for placement of grout.
- D. Avoid air entrapment during placement of grout.
- E. Place grout, completely filling equipment bases.
- F. Place grout on concrete bases and provide smooth bearing surface for equipment.
- G. Place grout around anchors.
- H. Cure placed grout.

**END OF SECTION 15050**

## SECTION 15055

### MOTORS

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes basic requirements for factory and field-installed installed motors.
- B. See Division 15 Section "Mechanical Vibration and Seismic Controls" for mounting motors and vibration isolation and seismic-control devices.
- C. See individual Sections for application of motors and reference to specific motor requirements for motor-driven equipment.
- D. This section includes requirements for motor starters to be provided, for all motors provided under division 15.

##### 1.2 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

##### 1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:
  - 1. Compatible with the following:
    - a. Magnetic controllers.
    - b. Multispeed controllers.
    - c. Reduced-voltage controllers.
    - d. Motor Control Centers.
  - 2. Motors for use with variable frequency drives shall meet all requirements of drive manufacturer, and shall be suitable for use throughout speed range without overheating.
  - 3. Matched to torque and horsepower requirements of the load.
  - 4. Matched to ratings and characteristics of supply circuit and required control sequence.

## **PART 2 - PRODUCTS**

### **2.1 MOTOR REQUIREMENTS**

- A. Motor requirements apply to factory and field-installed installed motors except as follows:
  - 1. Different ratings, performance, or characteristics for motor are specified in another Section.
  - 2. Motorized-equipment manufacturer requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.
- B. Motors shall be as manufactured by Allis Chalmers, Century, Baldour, Marathon, General Electric or Westinghouse. Motors provided with packaged equipment shall be of motor manufacturer as selected by equipment manufacturer.
- C. All motors furnished shall be Energy Efficient Electric Motors. The minimum nominal full-load efficiency for motors shall comply with Table 14-4 of the latest edition of the Washington State Energy Code.

### **2.2 MOTOR CHARACTERISTICS**

- A. Motors 3/4 HP and Larger: Three phase.
- B. Motors Smaller Than 3/4 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: Unless otherwise noted, single phase motors shall be capacitor-start type with service factor of 1.25 or higher. Three phase motors shall have a service factor of 1.15 or higher.
- F. Duty: Continuous duty at ambient temperature of 105 deg F and at altitude of 3300 feet above sea level.
- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

### **2.3 POLYPHASE MOTORS**

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1.

- C. Rotor: Squirrel cage, unless otherwise indicated.
- D. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- E. Temperature Rise: Match insulation rating, unless otherwise indicated.
- F. Insulation: Class F, unless otherwise indicated.
- G. Code Letter Designation:
  - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
  - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- H. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.

## 2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
  - 1. Designed with critical vibration frequencies outside operating range of controller output.
  - 2. Temperature Rise: Matched to rating for Class B insulation.
  - 3. Insulation: Class H.
  - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.
  - 1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
  - 1. Measure winding resistance.
  - 2. Read no-load current and speed at rated voltage and frequency.
  - 3. Measure locked rotor current at rated frequency.
  - 4. Perform high-potential test.

## 2.5 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
  - 1. Permanent-split capacitor.



2. Split-phase start, capacitor run.
  3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

### **PART 3 - EXECUTION**

**END OF SECTION 15055**

**SECTION 15060**  
**HANGERS AND SUPPORTS**

**PART 1 - GENERAL**

**1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Steel pipe hangers and supports.
  - 2. Trapeze pipe hangers.
  - 3. Metal framing systems.
  - 4. Thermal-hanger shield inserts.
  - 5. Fastener systems.
  - 6. Equipment supports.
- B. See Division 5 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
- C. See Division 13 Section "Fire-Suppression Piping" for fire protection piping.
- D. See Division 15 Section "Mechanical Vibration and Seismic Controls" for vibration isolation devices.
- E. See Division 15 Section "Pipe Expansion Fittings and Loops" for pipe guides and anchors.
- F. See Division 15 Section(s) "Metal Ducts" and "Nonmetal Ducts" for duct hangers and supports.

**1.2 DEFINITIONS**

- A. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

**1.3 PERFORMANCE REQUIREMENTS**

- A. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
  - 1. Steel pipe hangers and supports.
  - 2. Thermal-hanger shield inserts.
  - 3. Powder-actuated fastener systems.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following:
  - 1. Trapeze pipe hangers. Include Product Data for components.
  - 2. Metal framing systems. Include Product Data for components.
  - 3. Equipment supports.
- C. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

#### 2.2 STEEL PIPE HANGERS AND SUPPORTS

- A. Description: MSS SP-58, Types 1 through 58, factory-fabricated components. Refer to Part 3 "Hanger and Support Applications" Article for where to use specific hanger and support types.
- B. Manufacturers:
  - 1. B-Line Systems, Inc.; a division of Cooper Industries.
  - 2. ERICO/Michigan Hanger Co.
  - 3. Globe Pipe Hanger Products, Inc.
  - 4. Grinnell Corp.
  - 5. National Pipe Hanger Corporation.
  - 6. PHD Manufacturing, Inc.
  - 7. PHS Industries, Inc.
  - 8. Piping Technology & Products, Inc.

9. Tolco Inc.

C. Galvanized, Metallic Coatings: Pregalvanized or hot dipped.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

E. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion for support of bearing surface of piping.

## 2.3 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural-steel shapes with MSS SP-58 hanger rods, nuts, saddles, and U-bolts.

## 2.4 METAL FRAMING SYSTEMS

A. Description: MFMA-3, shop- or field-fabricated pipe-support assembly made of steel channels and other components.

B. Manufacturers:

1. B-Line Systems, Inc.; a division of Cooper Industries.
2. ERICO/Michigan Hanger Co.; ERISTRUT Div.
3. GS Metals Corp.
4. Power-Strut Div.; Tyco International, Ltd.
5. Thomas & Betts Corporation.
6. Tolco Inc.
7. Unistrut Corp.; Tyco International, Ltd.

C. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.

D. Nonmetallic Coatings: Plastic coating, jacket, or liner.

## 2.5 THERMAL-HANGER SHIELD INSERTS

A. Description: 100-psig minimum, compressive-strength insulation insert encased in sheet metal shield.

B. Manufacturers:

1. Carpenter & Paterson, Inc.
2. ERICO/Michigan Hanger Co.
3. PHS Industries, Inc.
4. Pipe Shields, Inc.
5. Rilco Manufacturing Company, Inc.
6. Value Engineered Products, Inc.

C. Insulation-Insert Material for Cold Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass with vapor barrier.

- D. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate or ASTM C 552, Type II cellular glass.
- E. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- F. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- G. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

## 2.6 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. Hilti, Inc.
    - b. ITW Ramset/Red Head.
    - c. Masterset Fastening Systems, Inc.
    - d. MKT Fastening, LLC.
    - e. Powers Fasteners.
- B. Mechanical-Expansion Anchors: Insert-wedge-type zinc-coated steel, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
  - 1. Manufacturers:
    - a. B-Line Systems, Inc.; a division of Cooper Industries.
    - b. Empire Industries, Inc.
    - c. Hilti, Inc.
    - d. ITW Ramset/Red Head.
    - e. MKT Fastening, LLC.
    - f. Powers Fasteners.

## 2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural-steel shapes.

## 2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

## **PART 3 - EXECUTION**

### **3.1 HANGER AND SUPPORT APPLICATIONS**

- A. Specific hanger and support requirements are specified in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized, metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use padded hangers for piping that is subject to scratching.
- F. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 .
  2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
  3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 , requiring clamp flexibility and up to 4 inches of insulation.
  4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
  5. U-Bolts (MSS Type 24): For support of heavy pipes, NPS 1/2 to NPS 30.
  6. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
  7. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from 2 rods if longitudinal movement caused by expansion and contraction might occur.
  8. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
- G. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
  1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
  2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.

- H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
  2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
- I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
  2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction to attach to top flange of structural shape.
  3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
  4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
  5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
  6. C-Clamps (MSS Type 23): For structural shapes.
  7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:
    - a. Light (MSS Type 31): 750 lb.
    - b. Medium (MSS Type 32): 1500 lb.
    - c. Heavy (MSS Type 33): 3000 lb.
  8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
  9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
- J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
  2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
  3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- K. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
  2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
  3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
- L. Comply with MSS SP-69 for trapeze pipe hanger selections and applications that are not specified in piping system Sections.

- M. Comply with MFMA-102 for metal framing system selections and applications that are not specified in piping system Sections.
- N. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

### 3.2 HANGER AND SUPPORT INSTALLATION

- A. Steel Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Trapeze Pipe Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated trapeze pipe hangers.
  - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
  - 2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D1.1.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
  - 1. Install powder-actuated fasteners in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
  - 2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Install lateral bracing with pipe hangers and supports to prevent swaying.
- J. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.



- K. Load Distribution: Install hangers and supports so piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.1 (for power piping) and ASME B31.9 (for building services piping) are not exceeded.
- M. Insulated Piping: Comply with the following:
  - 1. Attach clamps and spacers to piping.
    - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    - c. Do not exceed pipe stress limits according to ASME B31.1 for power piping and ASME B31.9 for building services piping.
  - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
  - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
  - 4. Shield Dimensions for Pipe: Not less than the following:
    - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    - b. NPS 4: 12 inches long and 0.06 inch thick.
    - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
  - 5. Pipes NPS 8 and Larger: Include wood inserts.
  - 6. Insert Material: Length at least as long as protective shield.
  - 7. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

### 3.3 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make smooth bearing surface.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

### 3.4 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

- C. Field Welding: Comply with AWS D1.1 procedures for shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work, and with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. Finish welds at exposed connections so no roughness shows after finishing and contours of welded surfaces match adjacent contours.

### 3.5 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

### 3.6 PAINTING

- A. Touch Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION 15060**

## **SECTION 15075**

### **MECHANICAL IDENTIFICATION**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Equipment markers.
3. Pipe markers.
4. Valve tags.

##### **1.2 SUBMITTALS**

- A. Product Data: For each type of product indicated.

##### **1.3 QUALITY ASSURANCE**

- A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

##### **1.4 REGULATORY REQUIREMENTS**

- A. Conform to NFPA 99 requirements for labeling and identification of medical gas piping systems and accessories.

#### **PART 2 - PRODUCTS**

##### **2.1 EQUIPMENT IDENTIFICATION DEVICES**

- A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:
  - a. Manufacturer, product name, model number, and serial number.
  - b. Capacity, operating and power characteristics, and essential data.
  - c. Labels of tested compliances.
2. Location: Accessible and visible.

3. Fasteners: As required to mount on equipment.
- B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
1. Terminology: Match schedules as closely as possible.
  2. Data:
    - a. Name and plan number.
    - b. Equipment service.
    - c. Design capacity.
    - d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  3. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

## 2.2 PIPING IDENTIFICATION DEVICES

- A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.
1. Colors: Comply with ASME A13.1, unless otherwise indicated.
  2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
  3. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers extending 360 degrees around pipe at each location.
  4. Pipes with OD, Including Insulation, 6 Inches and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
  5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.
- B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.
- C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.
- D. Self-Adhesive Pipe Markers: Plastic with pressure-sensitive, permanent-type, self-adhesive back.
- E. Plastic Tape: Continuously printed, vinyl tape at least 3 mils thick with pressure-sensitive, permanent-type, self-adhesive back.
1. Width for Markers on Pipes with OD, Including Insulation, Less Than 6 Inches: 3/4 inch minimum.
  2. Width for Markers on Pipes with OD, Including Insulation, 6 Inches or Larger: 1-1/2 inches minimum.

## 2.3 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers, with numbering scheme. Provide 5/32-inch hole for fastener.
  - 1. Material: 0.032-inch- thick brass or aluminum.
  - 2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS, GENERAL

- A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

### 3.2 EQUIPMENT IDENTIFICATION

- A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
  - 1. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
  - 2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  - 3. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  - 4. Fans, blowers, primary balancing dampers, and mixing boxes.
  - 5. Packaged HVAC central-station and zone-type or fan coil units.
- B. Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
  - 1. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 2. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - 3. Locate markers where accessible and visible. Include markers for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Meters, gages, thermometers, and similar units.
    - c. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.

- d. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  - e. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  - f. Fans, blowers, primary balancing dampers, and mixing boxes.
  - g. Packaged HVAC central-station and zone-type units.
  - h. Tanks and pressure vessels.
  - i. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- C. Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
- 1. Identify mechanical equipment with equipment markers in the following color codes:
    - a. Blue: For cooling equipment and components.
    - b. Red: For heating equipment and components.
    - c. Yellow: For combination cooling and heating equipment and components.
    - d. Brown: For energy-reclamation equipment and components.
  - 2. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - 3. Data: Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - 4. Include signs for the following general categories of equipment:
    - a. Main control and operating valves, including safety devices and hazardous units such as gas outlets.
    - b. Fuel-burning units, including boilers, furnaces, heaters, stills, and absorption units.
    - c. Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - d. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    - e. Fans, blowers, primary balancing dampers, and mixing boxes.
    - f. Packaged HVAC central-station and zone-type units.
    - g. Tanks and pressure vessels.
    - h. Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
- D. Install access panel markers with screws on equipment access panels.

### 3.3 PIPING IDENTIFICATION

- A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.
- 1. Pipes with OD, Including Insulation, Less Than 6 Inches: Pretensioned pipe markers. Use size to ensure a tight fit.
  - 2. Pipes with OD, Including Insulation, Less Than 6 Inches: Self-adhesive pipe markers. Use color-coded, self-adhesive plastic tape, at least 1-1/2 inches wide, lapped at least 1-1/2 inches at both ends of pipe marker, and covering full circumference of pipe.

3. Pipes with OD, Including Insulation, 6 Inches and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.
- B. Locate pipe markers and color bands where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed locations as follows:
  1. Near each valve and control device.
  2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  3. Near penetrations through walls, floors, ceilings, and nonaccessible enclosures.
  4. At access doors, manholes, and similar access points that permit view of concealed piping.
  5. Near major equipment items and other points of origination and termination.
  6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

### 3.4 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and as indicated in the following:
  1. Valve-Tag Size and Shape:
    - a. Cold Water: 1-1/2 inches, round.
    - b. Hot Water: 1-1/2 inches, round.
    - c. Gas: 1-1/2 inches, round.

### 3.5 ADJUSTING AND CLEANING

- A. Relocate mechanical identification materials and devices that have become visually blocked by other work.
- B. Clean faces of mechanical identification devices and frames of valve schedules.

## END OF SECTION 15075

## SECTION 15080

### MECHANICAL INSULATION

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes mechanical insulation for boiler breeching, duct, equipment, and pipe, including the following:
  - 1. Insulation Materials:
    - a. Cellular glass.
    - b. Flexible elastomeric.
    - c. Mineral fiber.
  - 2. Insulating cements.
  - 3. Adhesives.
  - 4. Mastics.
  - 5. Sealants.
  - 6. Factory-applied jackets.
  - 7. Field-applied jackets.
  - 8. Tapes.
  - 9. Securements.
  - 10. Corner angles.

##### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show details for the following:
  - 1. Application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Attachment and covering of heat tracing inside insulation.
  - 3. Insulation application at pipe expansion joints for each type of insulation.
  - 4. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Removable insulation at piping specialties, equipment connections, and access panels.
  - 6. Application of field-applied jackets.
  - 7. Application at linkages of control devices.
  - 8. Field application for each equipment type.
- C. Field quality-control inspection reports.



### 1.3 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: Insulation and related materials shall have fire-test-response characteristics indicated, as determined by testing identical products per ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, and cement material containers, with appropriate markings of applicable testing and inspecting agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 INSULATION MATERIALS

- A. Refer to Part 3 schedule articles for requirements about where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  - 1. Products:
    - a. See refer to manufacturers listed in specific insulation sections.
  - 2. Block Insulation: ASTM C 552, Type I.
  - 3. Special-Shaped Insulation: ASTM C 552, Type III.

4. Board Insulation: ASTM C 552, Type IV.
  5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- G. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
1. Products:
    - a. Aeroflex USA Inc.; Aerocel.
    - b. Armacell LLC; AP Armaflex.
    - c. RBX Corporation; Insul-Sheet 1800 and Insul-Tube 180.
- H. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Products:
    - a. CertainTeed Corp.; Duct Wrap.
    - b. Johns Manville; Microlite.
    - c. Knauf Insulation; Duct Wrap.
    - d. Manson Insulation Inc.; Alley Wrap.
    - e. Owens Corning; All-Service Duct Wrap.
- I. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ. For equipment applications, provide insulation with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Products:
    - a. CertainTeed Corp.; Commercial Board.
    - b. Fibrex Insulations Inc.; FBX.
    - c. Johns Manville; 800 Series Spin-Glas.
    - d. Knauf Insulation; Insulation Board.
    - e. Manson Insulation Inc.; AK Board.
    - f. Owens Corning; Fiberglas 700 Series.
- J. Mineral-Fiber, Preformed Pipe Insulation:
1. Products:
    - a. Fibrex Insulations Inc.; Coreplus 1200.
    - b. Johns Manville; Micro-Lok.
    - c. Knauf Insulation; 1000 Pipe Insulation.
    - d. Manson Insulation Inc.; Alley-K.
    - e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
  3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
- K. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in Part 2 "Factory-Applied Jackets" Article.
1. Products:
    - a. CertainTeed Corp.; CrimpWrap.
    - b. Johns Manville; MicroFlex.
    - c. Knauf Insulation; Pipe and Tank Insulation.
    - d. Manson Insulation Inc.; AK Flex.
    - e. Owens Corning; Fiberglas Pipe and Tank Insulation.

## 2.3 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449/C 449M.
- a. Insulco, Division of MFS, Inc.; SmoothKote.
  - b. P. K. Insulation Mfg. Co., Inc.; PK No. 127, and Quik-Cote.
  - c. Rock Wool Manufacturing Company; Delta One Shot.

## 2.4 ADHESIVES AND FASTENERS

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.
- B. Cellular-Glass and Polystyrene Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
1. Products:
    - a. Childers Products, Division of ITW; CP-96.
    - b. Foster Products Corporation, H. B. Fuller Company; 81-33.
- C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products:
    - a. Aeroflex USA Inc.; AeroSeal.
    - b. Armacell LCC; 520 Adhesive.

- c. Foster Products Corporation, H. B. Fuller Company; 85-75.
  - d. RBX Corporation; Rubatex Contact Adhesive.
  - e.
- D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- E. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-82.
    - b. Foster Products Corporation, H. B. Fuller Company; 85-20.
    - c. ITW TACC, Division of Illinois Tool Works; S-90/80.
    - d. Marathon Industries, Inc.; 225.
    - e. Mon-Eco Industries, Inc.; 22-25.
- F. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. Products:
    - a. Dow Chemical Company (The); 739, Dow Silicone.
    - b. Johns-Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    - c. P.I.C. Plastics, Inc.; Welding Adhesive.
    - d. Red Devil, Inc.; Celulon Ultra Clear.
    - e. Speedline Corporation; Speedline Vinyl Adhesive.

## 2.5 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates: Comply with MIL-C-19565C, Type II.
- B. Vapor-Barrier Mastic: Water based; suitable for indoor and outdoor use on below ambient services.
  - 1. Products:
    - a. Childers Products, Division of ITW; CP-35.
    - b. Foster Products Corporation, H. B. Fuller Company; 30-90.
    - c. ITW TACC, Division of Illinois Tool Works; CB-50.
    - d. Marathon Industries, Inc.; 590.
    - e. Mon-Eco Industries, Inc.; 55-40.

- f. Vimasco Corporation; 749.
  - 2. Water-Vapor Permeance: ASTM E 96, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 4. Solids Content: ASTM D 1644, 59 percent by volume and 71 percent by weight.
  - 5. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
- 1. Products:
    - a. Childers Products, Division of ITW; CP-10.
    - b. Foster Products Corporation, H. B. Fuller Company; 35-00.
    - c. ITW TACC, Division of Illinois Tool Works; CB-05/15.
    - d. Marathon Industries, Inc.; 550.
    - e. Mon-Eco Industries, Inc.; 55-50.
    - f. Vimasco Corporation; WC-1/WC-5.
  - 2. Water-Vapor Permeance: ASTM F 1249, 3 perms (2 metric perms) at 0.0625-inch (1.6-mm) dry film thickness.
  - 3. Service Temperature Range: Minus 20 to plus 200 deg F (Minus 29 to plus 93 deg C).
  - 4. Solids Content: 63 percent by volume and 73 percent by weight.
  - 5. Color: White.

## 2.6 SEALANTS

### A. Joint Sealants:

- 1. Joint Sealants for Cellular-Glass Products:
  - a. Childers Products, Division of ITW; CP-76.
  - b. Foster Products Corporation, H. B. Fuller Company; 30-45.
  - c. Marathon Industries, Inc.; 405.
  - d. Mon-Eco Industries, Inc.; 44-05.
  - e. Pittsburgh Corning Corporation; Pittseal 444.
  - f. Vimasco Corporation; 750.
- 2. Materials shall be compatible with insulation materials, jackets, and substrates.
- 3. Permanently flexible, elastomeric sealant.
- 4. Service Temperature Range: Minus 100 to plus 300 deg F.
- 5. Color: White or gray.

### B. FSK and Metal Jacket Flashing Sealants:

- 1. Products:
  - a. Childers Products, Division of ITW; CP-76-8.
  - b. Foster Products Corporation, H. B. Fuller Company; 95-44.
  - c. Marathon Industries, Inc.; 405.

- d. Mon-Eco Industries, Inc.; 44-05.
    - e. Vimasco Corporation; 750.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: Aluminum.
- C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
- 1. Products:
    - a. Childers Products, Division of ITW; CP-76.
  - 2. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 3. Fire- and water-resistant, flexible, elastomeric sealant.
  - 4. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 5. Color: White.

## 2.7 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
- 1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
  - 2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
  - 3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
  - 4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
- a. Products:
- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.
- 5. Vinyl Jacket: UL-rated white vinyl with a permeance of 1.3 perms when tested according to ASTM E 96, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products:
    - a. Johns Manville; Zeston.
    - b. P.I.C. Plastics, Inc.; FG Series.
    - c. Proto PVC Corporation; LoSmoke.
    - d. Speedline Corporation; SmokeSafe.
  2. Adhesive: As recommended by jacket material manufacturer.
  3. Color: White.
  4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
  5. Factory-fabricated tank heads and tank side panels.
- D. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105 or 5005, Temper H-14.
1. Products:
    - a. Childers Products, Division of ITW; Metal Jacketing Systems.
    - b. PABCO Metals Corporation; Surefit.
    - c. RPR Products, Inc.; Insul-Mate.
  2. Sheet and roll stock ready for shop or field sizing.
  3. Finish and thickness are indicated in field-applied jacket schedules.
  4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper.
  5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper.
  6. Factory-Fabricated Fitting Covers:
    - a. Same material, finish, and thickness as jacket.
    - b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
    - c. Tee covers.
    - d. Flange and union covers.
    - e. End caps.
    - f. Beveled collars.
    - g. Valve covers.
    - h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.
- E. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with white aluminum-foil facing.
1. Products:
    - a. Polyguard; Alumaguard 60.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136 and UL listed.
  - 1. Width: 3 inches.
  - 2. Thickness: 11.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136 and UL listed.
  - 1. Width: 3 inches.
  - 2. Thickness: 6.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive. Suitable for indoor and outdoor applications.
  - 1. Width: 2 inches.
  - 2. Thickness: 6 mils.
  - 3. Adhesion: 64 ounces force/inch in width.
  - 4. Elongation: 500 percent.
  - 5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive and UL listed.
  - 1. Width: 2 inches.
  - 2. Thickness: 3.7 mils.
  - 3. Adhesion: 100 ounces force/inch in width.
  - 4. Elongation: 5 percent.
  - 5. Tensile Strength: 34 lbf/inch in width.

## 2.10 SECUREMENTS

- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal.
- B. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - 1. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.



2. Spindle: [Copper- or zinc-coated, low carbon steel] [Aluminum], fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  3. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- C. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
1. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  2. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  3. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
- D. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
1. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  2. Spindle: Copper or zinc-coated, low carbon steel, Aluminum, Stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  3. Adhesive-backed base with a peel-off protective cover.
- E. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel, aluminum sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
1. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
- F. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
- G. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- H. Wire: 0.062-inch soft-annealed, stainless steel.

## 2.11 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105 or 5005; Temper H-14.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

### **3.2 COMMON INSTALLATION REQUIREMENTS**

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.
- B. Install insulation with tightly butted joints free of voids and gaps. Vapor barriers shall be continuous. Before installing jacket material, install vapor-barrier system.
- C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.
- G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- H. Keep insulation materials dry during application and finishing.
- I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- J. Install insulation with least number of joints practical.
- K. Hangers and Anchors: Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.

3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- M. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
    - a. For below ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.
- N. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- O. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- Q. For above ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.
- R. Ductwork with ductliner that has been allowed to become wet during the construction process will be removed from the site and replaced with new ductwork and liner

### 3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Below-Grade Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
  - 1. Seal penetrations with flashing sealant.
  - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  - 4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions. Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
  - 1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Through-Penetration Firestop Systems."
- F. Insulation Installation at Floor Penetrations:
  - 1. Duct: Install insulation continuously through floor penetrations that are not fire rated. For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  - 2. Pipe: Install insulation continuously through floor penetrations.
  - 3. Seal penetrations through fire-rated assemblies according to Division 7 Section "Through-Penetration Firestop Systems."

### 3.4 DUCT AND PLENUM INSULATION INSTALLATION

#### A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Impale insulation over pins and attach speed washers.
  - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

#### B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
  - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not overcompress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to 2 times the insulation thickness but not less than 3 inches.
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

### 3.5 EQUIPMENT, TANK, AND VESSEL INSULATION INSTALLATION

- A. Secure insulation with adhesive and anchor pins and speed washers.
  1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of tank and vessel surfaces.

2. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
  3. Protect exposed corners with secured corner angles.
  4. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
    - a. Do not weld anchor pins to ASME-labeled pressure vessels.
    - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
    - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
    - d. Do not overcompress insulation during installation.
    - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
    - f. Impale insulation over anchor pins and attach speed washers.
    - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  5. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
  6. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.
  7. Stagger joints between insulation layers at least 3 inches.
  8. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
  9. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
  10. For equipment with surface temperatures below ambient, apply vapor-barrier mastic to open ends, joints, seams, breaks, and punctures in insulation. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from 1 edge and 1 end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
- B. Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.
1. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.

2. Seal longitudinal seams and end joints.

### 3.6 PIPE INSULATION INSTALLATION

- A. Requirements in this Article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Secure single-layer insulation with bands at 12-inch intervals and tighten bands without deforming insulation materials.
- C. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with bands at 12-inch intervals.
- D. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
- E. Cover segmented insulated surfaces with a layer of insulating cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
- F. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
- G. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.
- H. Insulation Installation on Straight Pipes and Tubes:
  1. Secure each layer of preformed insulation to pipe with wire or bands and tighten bands without deforming insulation materials. Orient longitudinal joints between half sections in 3 and 9 o'clock positions on the pipe.
  2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
  3. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
  4. For insulation with factory-applied jackets with vapor barriers, do not staple longitudinal tabs but secure tabs with additional adhesive or tape as recommended by insulation material manufacturer and seal with vapor-barrier mastic.
  5. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.
- I. Insulation Installation on Pipe Flanges:
  1. Install preformed pipe insulation to outer diameter of pipe flange.



2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of same insulation material and thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.
5. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

J. Insulation Installation on Pipe Fittings and Elbows:

1. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
2. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.

K. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.
5. Install insulation to flanges as specified for flange insulation application.

L. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

M. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

N. Special Installation Requirements for Flexible Elastomeric and Polyolefin Insulation:

1. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Flanges:
  - a. Install pipe insulation to outer diameter of pipe flange.
  - b. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
  - c. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
  - d. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows:
  - a. Install mitered sections of pipe insulation.
  - b. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch- wide joint strips at end joints.

5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-retarder mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive.
  1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.
- C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

### 3.8 FINISHES

- A. Duct, Equipment, and Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket as specified in Division 9 painting Sections.
  1. Apply two finish coats of interior, flat, latex-emulsion size over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Do not field paint aluminum jackets.

### 3.9 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  1. Inspect ductwork, randomly selected by Owners Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
  2. Inspect field-insulated equipment, randomly selected by Owners Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
  3. Inspect pipe, fittings, strainers, and valves, randomly selected by Owners Representative, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

- B. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements. Remove defective Work.
- C. Install new insulation and jackets to replace insulation and jackets removed for inspection. Repeat inspection procedures after new materials are installed.

### 3.10 BOILER BREECHING INSULATION SCHEDULE

- A. Exposed, Breeching and Connector Insulation: High-temperature mineral-fiber board, 3 inches thick and 3-lb/cu. ft. nominal density.
- B. Concealed, Breeching and Connector Insulation: High-temperature mineral-fiber blanket or board, 3 inches thick and 3-lb/cu. ft. nominal density.

### 3.11 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Outdoor, exposed supply and return.
- B. Items Not Insulated:
  - 1. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
  - 2. Factory-insulated flexible ducts.
  - 3. Factory-insulated plenums and casings.
  - 4. Flexible connectors.
  - 5. Vibration-control devices.
  - 6. Factory-insulated access panels and doors.

### 3.12 DUCTWORK LOCATED EXTERNAL TO BUILDING ENVELOPE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.
- B. Supply and Return Air Duct and Plenum Insulation: Mineral-fiber blanket or board, 3 inches thick and 3-lb/cu. ft. nominal density. Minimum overall R-value shall be R-12.

### 3.13 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Fire-suppression piping.
  - 2. Drainage piping located in crawl spaces.
  - 3. Below-grade piping.
  - 4. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

### 3.14 PIPING INSULATION SCHEDULE

#### A. Piping Insulation Table:

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity Btu in/(h ft <sup>2</sup> °F)	Mean Rating Temperature (°F)	<1	1 to <1.5	1.5 to <4	4 to <8	8 and up
>350	0.32 -0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 -0.32	200	3.0	4.0	4.5	4.5	4.5
201 - 250	0.27 -0.30	150	2.5	2.5	2.5	3.0	4.0
141 - 200	0.25 -0.29	125	1.5	1.5	2.0	2.0	2.0
105 - 140	0.21 -0.28	100	1.0	1.0	1.5	1.5	1.5
40 - 60	0.21 -0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 -0.26	20	0.5	1.0	1.0	1.0	1.5

#### B. Piping Insulation Notes:

1. Runouts to fixtures which are less than 12 feet in length may have ½ inch insulation.
2. Runouts to fixtures which are less than 12 feet in length may have 1 inch insulation.
3. Runouts to fixtures which are less than 12 feet in length may have 1-½ inches insulation.

### 3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. None.

D. Ducts and Plenums, Exposed:

1. Aluminum, stucco embossed, 0.040 inch thick.

E. Equipment, Exposed:

1. Aluminum, stucco embossed with z-shaped locking seam, 0.040 inch thick.

F. Piping, Concealed:

1. None.

G. Piping, Exposed:

1. PVC, 40 mils thick.
2. Aluminum, stucco embossed with z-shaped locking seam, 0.040 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

- A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

**END OF SECTION 15080**

## **SECTION 15140**

### **DOMESTIC WATER PIPING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes domestic water piping inside the building.
- B. Water meters will be furnished and installed by utility company.
- C. See Division 2 Section "Water Distribution" for water-service piping outside the building from source to the point where water-service piping enters the building.
- D. See Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
- E. See Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

##### **1.2 SUBMITTALS**

- A. Field quality-control test reports.

##### **1.3 QUALITY ASSURANCE**

- A. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

#### **PART 2 - PRODUCTS**

##### **2.1 PIPING MATERIALS**

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.
- B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

##### **2.2 COPPER TUBE AND FITTINGS**

- A. Hard Copper Tube: ASTM B 88, Type L water tube, drawn temper.
- B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

- C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.
- E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- F. Copper Unions:
  - 1. MSS SP-123.
  - 2. Cast-copper-alloy, hexagonal-stock body.
  - 3. Ball-and-socket, metal-to-metal seating surfaces.
  - 4. Solder-joint or threaded ends.
- G. Copper Pressure-Seal-Joint Fittings:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Elkhart Products Corporation.
    - b. NIBCO Inc.
    - c. Viega.
  - 2. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
  - 3. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
- H. Copper-Tube, Extruded-Tee Connections:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. T-Drill Industries Inc.
  - 2. Description: Tee formed in copper tube according to ASTM F 2014.
- I. Appurtenances for Grooved-End Copper Tubing:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Anvil International.
    - b. Shurjoint Piping Products.
    - c. Victaulic Company.
  - 2. Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 copper tube or ASTM B 584 bronze castings.
  - 3. Mechanical Couplings for Grooved-End Copper Tubing:



- a. Copper-tube dimensions and design similar to AWWA C606.
- b. Ferrous housing sections.
- c. EPDM-rubber gaskets suitable for hot and cold water.
- d. Bolts and nuts.
- e. Minimum Pressure Rating: 300 psig.

## 2.3 PEX TUBE AND FITTINGS

- A. PEX Distribution System: ASTM F 877, SDR 9 tubing.
- B. Fittings for PEX Tube: ASTM F 1807, metal-insert type with copper or stainless-steel crimp rings and matching PEX tube dimensions.
- C. Manifold: Multiple-outlet, plastic or corrosion-resistant-metal assembly complying with ASTM F 877; with plastic or corrosion-resistant-metal valve for each outlet.

## 2.4 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials:
  - 1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
  - 2. Full-face or ring type unless otherwise indicated.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. Solder Filler Metals: ASTM B 32, lead-free alloys.
- D. Flux: ASTM B 813, water flushable.
- E. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

## 2.5 VALVES

- A. Bronze and cast-iron, general-duty valves are specified in Division 15 Section "Valves."
- B. Balancing and drain valves are specified in Division 15 Section "Plumbing Specialties."

# PART 3 - EXECUTION

## 3.1 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

### 3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
- C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.
- D. Install underground copper tube and ductile-iron pipe in PE encasement according to ASTM A 674 or AWWA C105/A21.5.
- E. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 15122 "Meters and Gages" and with requirements for drain valves and strainers in Section 15145 "Domestic Water Piping Specialties."
- F. Install shutoff valve immediately upstream of each dielectric fitting.
- G. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 15145 "Domestic Water Piping Specialties."
- H. Install domestic water piping level and plumb.
- I. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- J. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
- K. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
- L. Install piping to permit valve servicing.
- M. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
- N. Install piping free of sags and bends.
- O. Install fittings for changes in direction and branch connections.
- P. Install PEX piping with loop at each change of direction of more than 90 degrees.
- Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

- R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 15140 "Meters and Gages."
- S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 15441 "Domestic Water Pumps."
- T. Install thermometers on outlet piping from each water heater. Comply with requirements for thermometers in Section 15140 "Meters and Gages."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors.

### 3.3 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- D. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."
- E. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
- F. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2104. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.
- G. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
- H. Joint Construction for Grooved-End, Ductile-Iron Piping: Make joints according to AWWA C606. Cut round-bottom grooves in ends of pipe at gasket-seat dimension required for specified (flexible or rigid) joint. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections over gasket with keys seated in piping grooves. Install and tighten housing bolts.

- I. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.
- J. Joints for PEX Piping: Join according to ASTM F 1807.
- K. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

### 3.4 TRANSITION FITTING INSTALLATION

- A. Install transition couplings at joints of dissimilar piping.
- B. Transition Fittings in Underground Domestic Water Piping:
  - 1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
  - 2. Fittings for NPS 2 and Larger: Sleeve-type coupling.
- C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

### 3.5 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings, nipples or unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges or flange kits.
- D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

### 3.6 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hanger, support products, and installation in Section 15060 "Hangers and Supports."
  - 1. Vertical Piping: MSS Type 8 or 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Support vertical piping and tubing at base and at each floor.

- C. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.
- D. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
  - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 6. NPS 6: 10 feet with 5/8-inch rod.
  - 7. NPS 8: 10 feet with 3/4-inch rod.
- E. Install supports for vertical copper tubing every 10 feet.
- F. Install vinyl-coated hangers for PEX piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1 and Smaller: 32 inches with 3/8-inch rod.
- G. Install hangers for vertical PEX piping every 48 inches.
- H. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
  - 2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6: 48 inches with 3/4-inch rod.
  - 5. NPS 8: 48 inches with 7/8-inch rod.
- I. Install supports for vertical PVC piping every 48 inches.
- J. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

### 3.7 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.
- C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
  - 1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.

2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

### 3.8 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification materials and installation in Section 15075 "Mechanical Identification."
- B. Label pressure piping with system operating pressure.

### 3.9 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
  1. Piping Inspections:
    - a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
    - b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
      - 1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
      - 2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
    - c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
    - d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
  2. Piping Tests:
    - a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
    - b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
    - c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

- d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
  - e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
  - f. Prepare reports for tests and for corrective action required.
- B. Domestic water piping will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.10 ADJUSTING

- A. Perform the following adjustments before operation:
  - 1. Close drain valves, hydrants, and hose bibbs.
  - 2. Open shutoff valves to fully open position.
  - 3. Open throttling valves to proper setting.
  - 4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    - a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    - b. Adjust calibrated balancing valves to flows indicated.
  - 5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
  - 6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
  - 7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
  - 8. Check plumbing specialties and verify proper settings, adjustments, and operation.

### 3.11 CLEANING

- A. Clean and disinfect potable domestic water piping as follows:
  - 1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  - 2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Fill and isolate system according to either of the following:
      - 1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.

- 2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
  - c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
  - d. Repeat procedures if biological examination shows contamination.
  - e. Submit water samples in sterile bottles to authorities having jurisdiction.
- B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
  2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    - a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    - b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.
- D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

### 3.12 PIPING SCHEDULE

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
- B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be the following:
1. Soft copper tube, ASTM B 88, Type K with no joints below the slab.
- E. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be the following:
1. Mechanical-joint, ductile-iron pipe; standard pattern, mechanical-joint fittings; and mechanical joints.
- F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:
1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints. Shall be Lead Free NSF/ANSI 61 compliant.
  2. Hard copper tube, ASTM B 88, Type L; copper pressure-seal-joint fittings; and pressure-sealed joints.



3. PEX tube, NPS 1 and smaller; fittings for PEX tube; and crimped joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

H. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L; grooved-joint, copper-tube appurtenances; and grooved joints.

### 3.13 VALVE SCHEDULE

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use ball or gate valves for piping NPS 2 and smaller. Use butterfly, ball, or gate valves with flanged ends for piping NPS 2-1/2 and larger.
2. Throttling Duty: Use ball or globe valves for piping NPS 2 and smaller. Use butterfly or ball valves with flanged ends for piping NPS 2-1/2 and larger.
3. Hot-Water Circulation Piping, Balancing Duty: Calibrated balancing valves.
4. Drain Duty: Hose-end drain valves.

B. Use check valves to maintain correct direction of domestic water flow to and from equipment.

C. Iron grooved-end valves may be used with grooved-end piping.

## END OF SECTION 15140

## SECTION 15145

### DOMESTIC WATER PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following domestic water piping specialties:
  - 1. Backflow preventers.
  - 2. Balancing valves.
  - 3. Strainers.
  - 4. Hose bibbs.
  - 5. Wall hydrants.
  - 6. Drain valves.
  - 7. Water hammer arresters.
  - 8. Trap-seal primer valves.
- B. See Division 15 Section "Domestic Water Piping" for water meters.
- C. See Division 15 Section "Drinking Fountains and Water Coolers" for water filters for water coolers.
- D. See Division 15 Section "Water Filtration Equipment" for water filters in domestic water piping.

##### 1.2 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig, unless otherwise indicated.

##### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Field quality-control test reports.
- C. Operation and maintenance data.

##### 1.4 QUALITY ASSURANCE

- A. NSF Compliance:
  - 1. Comply with NSF 14, "Plastics Piping Components and Related Materials," for plastic domestic water piping components.

2. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9."

## **PART 2 - PRODUCTS**

### **2.1 BACKFLOW PREVENTERS**

#### **A. Reduced-Pressure-Principle Backflow Preventers:**

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Ames Co.
  - b. Conbraco Industries, Inc.
  - c. FEBCO; SPX Valves & Controls.
  - d. Flomatic Corporation.
  - e. Watts Industries, Inc.; Water Products Div.
  - f. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle 1/3 of flow range.
5. Body: Bronze for NPS 2 and smaller.
6. End Connections: Threaded for NPS 2 and smaller.
7. Accessories:
  - a. Valves: Ball type with threaded ends on inlet and outlet of NPS 2 and smaller; outside screw and yoke gate-type with flanged ends on inlet and outlet of NPS 2-1/2 and larger.
  - b. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

### **2.2 BALANCING VALVES**

#### **A. Memory-Stop Balancing Valves:**

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Conbraco Industries, Inc.
  - b. Crane Co.; Crane Valve Group; Crane Valves.
  - c. Crane Co.; Crane Valve Group; Jenkins Valves.
  - d. Crane Co.; Crane Valve Group; Stockham Div.
  - e. Hammond Valve.
  - f. Milwaukee Valve Company.
  - g. NIBCO INC.
  - h. Red-White Valve Corp.
2. Standard: MSS SP-110 for two-piece, copper-alloy ball valves.

3. Pressure Rating: 400-psig minimum CWP.
4. Size: NPS 2 or smaller.
5. Body: Copper alloy.
6. Port: Standard or full port.
7. Ball: Chrome-plated brass.
8. Seats and Seals: Replaceable.
9. End Connections: Solder joint or threaded.
10. Handle: Vinyl-covered steel with memory-setting device.

## 2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

### A. Water-Temperature Limiting Devices:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Armstrong International, Inc.
  - b. Cash Acme.
  - c. Conbraco Industries, Inc.
  - d. Honeywell Water Controls.
  - e. Legend Valve.
  - f. Leonard Valve Company.
  - g. Powers; a Watts Industries Co.
  - h. Symmons Industries, Inc.
  - i. Taco, Inc.
  - j. Watts Industries, Inc.; Water Products Div.
  - k. Zurn Plumbing Products Group; Wilkins Div.
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded[ **union**] inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Valve Finish: Chrome plated or Rough bronze.

## 2.4 STRAINERS FOR DOMESTIC WATER PIPING

### A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum, unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller.
3. End Connections: Threaded for NPS 2 and smaller.
4. Screen: Stainless steel with round perforations, unless otherwise indicated.
5. Drain: Factory-installed, hose-end drain valve.

## 2.5 HOSE BIBBS

### A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Chrome or nickel plated.
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Wheel handle.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

## 2.6 WALL HYDRANTS

### A. Nonfreeze Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company.
  - b. MIFAB, Inc.
  - c. Prier Products, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Tyler Pipe; Wade Div.
  - f. Watts Drainage Products Inc.
  - g. Woodford Manufacturing Company.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.21.3M for **exposed**-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounting with cover.
9. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.

10. Nozzle and Wall-Plate Finish: Polished nickel bronze.
11. Operating Keys(s): Two with each wall hydrant.

## 2.7 DRAIN VALVES

### A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

## 2.8 WATER HAMMER ARRESTERS

### A. Water Hammer Arresters:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AMTROL, Inc.
  - b. Josam Company.
  - c. MIFAB, Inc.
  - d. PPP Inc.
  - e. Sioux Chief Manufacturing Company, Inc.
  - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - g. Tyler Pipe; Wade Div.
  - h. Watts Drainage Products Inc.
  - i. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

## 2.9 TRAP-SEAL PRIMER VALVES

### A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. MIFAB, Inc.

- b. PPP Inc.
  - c. Sioux Chief Manufacturing Company, Inc.
  - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
  - e. Watts Industries, Inc.; Water Products Div.
2. Standard: ASSE 1018.
  3. Pressure Rating: 125 psig minimum.
  4. Body: Bronze.
  5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
  6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
  7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Refer to Division 15 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.
  1. Locate backflow preventers in same room as connected equipment or system.
  2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.
  3. Do not install bypass piping around backflow preventers.
- C. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.
- D. Install balancing valves in locations where they can easily be adjusted.
- E. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
  1. Install thermometers and water regulators if specified.
  2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- F. Install Y-pattern strainers for water on supply side of each control valve, and pump.
- G. Install water hammer arresters in water piping according to PDI-WH 201.
- H. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

- I. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping and specialties.
- J. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
  - 1. Intermediate atmospheric-vent backflow preventers.
  - 2. Reduced-pressure-principle backflow preventers.
  - 3. Double-check backflow-prevention assemblies.
  - 4. Water pressure-reducing valves.
  - 5. Primary, thermostatic, water mixing valves.
  - 6. Supply-type, trap-seal primer valves.
- K. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 15 Section "Mechanical Identification."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and prepare test reports:
  - 1. Test each reduced-pressure-principle backflow preventer according to authorities having jurisdiction and the device's reference standard.
- B. Remove and replace malfunctioning domestic water piping specialties and retest as specified above.

### 3.3 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

**END OF SECTION 15145**



## **SECTION 15150**

### **SANITARY WASTE AND VENT PIPING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
  - 1. Pipe, tube, and fittings.
  - 2. Special pipe fittings.
- B. See Division 15 Section "Chemical-Waste Piping" for chemical-waste and vent piping systems.

##### **1.2 PERFORMANCE REQUIREMENTS**

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
  - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

##### **1.3 SUBMITTALS**

- A. Field quality-control inspection and test reports.

##### **1.4 QUALITY ASSURANCE**

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping; and "NSF-drain" for plastic drain piping.

#### **PART 2 - PRODUCTS**

##### **2.1 PIPING MATERIALS**

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
  - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
  - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
  - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
  1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.
- D. ABS Pipe: ASTM D 2661, Schedule 40, solid wall.
  1. ABS Socket Fittings: ASTM D 2661, made to ASTM D 3311, drain, waste, and vent patterns.
- E. PVC Pipe: ASTM D 2665, solid-wall drain, waste, and vent.
  1. PVC Socket Fittings: ASTM D 2665, socket type, made to ASTM D 3311, drain, waste, and vent patterns.

## **PART 3 - EXECUTION**

### **3.1 PIPING APPLICATIONS**

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
  2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
  4. PVC pipe, PVC socket fittings, and solvent-cemented joints.
- D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
  1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.
  2. Hubless cast-iron soil pipe and fittings; standard, shielded, stainless-steel couplings; and hubless-coupling joints.
  3. ABS pipe, ABS socket fittings, and solvent-cemented joints.
  4. PVC pipe, PVC socket fittings, and solvent-cemented joints.

### 3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."
- B. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.
- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
  - 1. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
  - 2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Install ABS soil and waste drainage and vent piping according to ASTM D 2661.
- L. Install PVC soil and waste drainage and vent piping according to ASTM D 2665.

- M. Install underground ABS and PVC soil and waste drainage piping according to ASTM D 2321.
- N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

### 3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
  - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
  - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- D. PVC Nonpressure Piping Joints: Join piping according to ASTM D 2665.

### 3.4 HANGER AND SUPPORT INSTALLATION

- A. Pipe hangers and supports are specified in Division 15 Section "Hangers and Supports." Install the following:
  - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
  - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
    - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
  - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
  - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 15 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- E. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
  - 2. NPS 3: 60 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
  - 4. NPS 6: 60 inches with 3/4-inch rod.

- 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- F. Install supports for vertical cast-iron soil piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
  - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
  - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
  - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
  - 5. NPS 6: 10 feet with 5/8-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.
- I. Install hangers for ABS and PVC piping with the following maximum horizontal spacing and minimum rod diameters:
  - 1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
  - 2. NPS 3: 48 inches with 1/2-inch rod.
  - 3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
  - 4. NPS 6: 48 inches with 3/4-inch rod.
- J. Install supports for vertical ABS and PVC piping every 48 inches.
- K. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

### 3.5 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
  - 1. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
  - 2. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Specialties."
  - 3. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections **NPS 2-1/2** and larger.

### 3.6 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
  2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
  2. Prepare reports for tests and required corrective action.
- 3.7 CLEANING
- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.
- 3.8 PROTECTION
- A. Exposed ABS and PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

**END OF SECTION 15150**

## SECTION 15155

### SANITARY WASTE PIPING SPECIALTIES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following sanitary drainage piping specialties:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

##### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

##### 1.3 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

#### PART 2 - PRODUCTS

##### 2.1 CLEANOUTS

- A. Exposed Metal Cleanouts:

1. ASME A112.36.2M, Cast-Iron Cleanouts:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Josam Company.
- 2) MIFAB, Inc.
- 3) Smith, Jay R. Mfg. Co.
- 4) Tyler Pipe.
- 5) Watts Drainage Products.
- 6) Zurn Plumbing Products Group.

2. ASME A112.3.1, Stainless-Steel Cleanouts:

- a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Josam Company.
  3. Standard: ASME A112.36.2M for cast iron, and ASME A112.3.1 for stainless steel for cleanout test tee.
  4. Size: Same as connected drainage piping
  5. Body Material: Hubless, cast-iron soil pipe test tee or Stainless-steel tee with side cleanout as required to match connected piping.
  6. Closure: Countersunk or raised-head, brass plug.
  7. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
  8. Closure: Stainless-steel plug with seal.
- B. Metal Floor Cleanouts:
1. ASME A112.36.2M, Cast-Iron Cleanouts:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Josam Company.
      - 2) Oatey.
      - 3) Sioux Chief Manufacturing Co., Inc.
      - 4) Smith, Jay R. Mfg. Co.
      - 5) Tyler Pipe.
      - 6) Watts Drainage Products.
      - 7) Zurn Plumbing Products Group.
  2. ASME A112.36.2M, Stainless-Steel Cleanouts:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Josam Company.
      - 2) Kusel Equipment Co.
      - 3) Smith, Jay R. Mfg. Co.
  3. ASME A112.3.1, Stainless-Steel Cleanouts:
    - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      - 1) Josam Company.
  4. Standard: ASME A112.36.2M for adjustable housing cleanout.
  5. Size: Same as connected branch.
  6. Type: Adjustable housing.
  7. Body or Ferrule: Cast iron.
  8. Clamping Device: Not required.
  9. Outlet Connection: Inside cask, Spigot, or Threaded.



10. Closure: Brass plug with tapered threads.
11. Adjustable Housing Material: Cast iron with threads.
12. Frame and Cover Material and Finish: Polished bronze.
13. Top Loading Classification: Heavy Duty.
14. Riser: ASTM A 74, Service class, cast-iron drainage pipe fitting and riser to cleanout.
15. Standard: ASME A112.3.1.
16. Size: Same as connected branch.
17. Housing: Stainless steel.
18. Closure: Stainless steel with seal.
19. Riser: Stainless-steel drainage pipe fitting to cleanout.

C. Cast-Iron Wall Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Josam Company; Josam Div.
  - b. MIFAB, Inc.
  - c. Smith, Jay R. Mfg. Co.
  - d. Tyler Pipe; Wade Div.
  - e. Watts Drainage Products.
  - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

D. Plastic Floor Cleanouts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Canplas LLC.
  - b. IPS Corporation.
  - c. NDS Inc.
  - d. Plastic Oddities.
  - e. Sioux Chief Manufacturing Company, Inc.
  - f. Zurn Plumbing Products Group; Light Commercial Operation.
2. Size: Same as connected branch.
3. Body: PVC.
4. Closure Plug: PVC.

5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

## 2.2 FLOOR DRAINS

### A. Cast-Iron Floor Drains:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Commercial Enameling Co.
  - b. Josam Company; Josam Div.
  - c. MIFAB, Inc.
  - d. Prier Products, Inc.
  - e. Smith, Jay R. Mfg. Co.
  - f. Tyler Pipe; Wade Div.
  - g. Watts Drainage Products.
  - h. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASME A112.6.3.
3. Pattern: As scheduled.
4. Body Material: Gray iron.
5. Seepage Flange: Required.
6. Anchor Flange: Required.
7. Clamping Device: Required.
8. Coating on Interior and Exposed Exterior Surfaces: As scheduled.
9. Sediment Bucket: As scheduled.
10. Top or Strainer Material: As Scheduled.
11. Top of Body and Strainer Finish: As scheduled.
12. Top Shape: Round or Square as scheduled.
13. Top Loading Classification: Medium Duty unless noted otherwise.
14. Funnel: As scheduled.
15. Trap Features: Trap-seal primer valve drain connection.

### B. Stainless-Steel Floor Drains:

1. ASME A112.3.1, Stainless-Steel Floor Drains:
  - a. Manufacturers: Subject to compliance with requirements, into the Work include, but are not limited to, the following:
    - 1) Josam Company.
2. ASME A112.6.3, Stainless-Steel Floor Drains:
  - a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - 1) Josam Company.

- 2) Smith, Jay R. Mfg. Co.
- 3) Watts Drainage Products.
- 4) Zurn Plumbing Products Group.

3. Standard: ASME A112.3.1.

## 2.3 ROOF FLASHING ASSEMBLIES

### A. Roof Flashing Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Acorn Engineering Company; Elmdor/Stoneman Div.
  - b. Thaler Metal Industries Ltd.

B. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 8 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

1. Open-Top Vent Cap: Without cap.

## 2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

### A. Floor-Drain, Trap-Seal Primer Fittings:

1. Description: Cast iron, with threaded inlet and threaded or spigot outlet, and trap-seal primer valve connection.
2. Size: Same as floor drain outlet with NPS 1/2 side inlet.

### B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

### C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

### D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

## 2.5 FLASHING MATERIALS

- A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:
  1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
  2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
  3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.
- B. Fasteners: Metal compatible with material and substrate being fastened.
- C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.
- D. Solder: ASTM B 32, lead-free alloy.
- E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Refer to Division 15 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
  1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
  2. Locate at each change in direction of piping greater than 45 degrees.
  3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
  4. Locate at base of each vertical soil and waste stack.
- D. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.
- E. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

- F. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
  - 1. Position floor drains for easy access and maintenance.
  - 2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:
    - a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    - b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    - c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.
  - 3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
  - 4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- G. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.
- H. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.
- I. Assemble open drain fittings and install with top of hub 1 inch above floor.
- J. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- K. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
  - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
  - 2. Size: Same as floor drain inlet.
- L. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.
- M. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.
- N. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.
- O. Install escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

### 3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.

### 3.3 FLASHING INSTALLATION

- A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:
  - 1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.
- B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.
  - 1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
  - 2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
  - 3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.
- C. Set flashing on floors and roofs in solid coating of bituminous cement.
- D. Secure flashing into sleeve and specialty clamping ring or device.
- E. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

### 3.4 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 15 Section "Identification for Plumbing Piping and Equipment."

### 3.5 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

**END OF SECTION 15155**

## SECTION 15412

### EMERGENCY PLUMBING FIXTURES

#### PART 1 - GENERAL

##### 1.1 SUMMARY

- A. This Section includes the following emergency plumbing fixtures:
  - 1. Eyewash equipment.
  - 2. Combination units.
  - 3. Water-tempering equipment.
- B. See Division 15 Section "Plumbing Specialties" for backflow preventers and floor drains.

##### 1.2 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Tepid: Moderately warm.

##### 1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Operation and maintenance data.

##### 1.4 QUALITY ASSURANCE

- A. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- B. Regulatory Requirements: Comply with requirements in ICC A117.1, "Accessible and Usable Buildings and Facilities"; Public Law 90-480, "Architectural Barriers Act"; and Public Law 101-336, "Americans with Disabilities Act"; for plumbing fixtures for people with disabilities.
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components--Health Effects," for fixture materials that will be in contact with potable water.

## PART 2 - PRODUCTS

### 2.1 EYEWASH EQUIPMENT

#### A. Eyewash Equipment:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Bradley Corporation.
  - b. Chicago Faucets.
  - c. Encon Safety Products.
  - d. Guardian Equipment Co.
  - e. Haws Corporation.
  - f. Lab Safety Supply Inc.
  - g. Murdock, Inc.
  - h. Sellstrom Manufacturing Co.
  - i. Speakman Company.
  - j. WaterSaver Faucet Co.
  - k. Western Emergency Equipment.
2. Description: Plumbed, freestanding eyewash equipment.
  - a. Capacity: Deliver potable water at rate not less than 0.4 gpm for at least 15 minutes.
  - b. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
  - c. Control-Valve Actuator: Paddle.
  - d. Receptor: Plastic bowl.
  - e. Drain Piping: NPS 1-1/4 minimum, chrome-plated brass, receptor drain, P-trap, waste to wall, and wall flange complying with ASME A112.18.2.

### 2.2 COMBINATION UNITS

#### A. Combination Units:

1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - a. Bradley Corporation.
  - b. Chicago Faucets.
  - c. Encon Safety Products.
  - d. Guardian Equipment Co.
  - e. Haws Corporation.
  - f. Lab Safety Supply Inc.
  - g. Murdock, Inc.
  - h. Sellstrom Manufacturing Co.
  - i. Speakman Company.
  - j. WaterSaver Faucet Co.



- k. Western Emergency Equipment.
- 2. Description: Plumbed, accessible, freestanding, with emergency shower and eyewash equipment.
  - a. Piping:
    - 1) Unit Supply: NPS 1-1/4 minimum from top.
    - 2) Unit Drain: Outlet at side near bottom.
    - 3) Shower Supply: NPS 1 with flow regulator and stay-open control valve.
    - 4) Eyewash Supply: NPS 1/2 with flow regulator and stay-open control valve.
  - b. Shower Capacity: Deliver potable water at rate not less than 20 gpm for at least 15 minutes.
    - 1) Control-Valve Actuator: Pull rod.
    - 2) Shower Head: 8-inch minimum diameter, plastic.
  - c. Eyewash Equipment: With capacity to deliver potable water at rate not less than 0.4 gpm for at least 15 minutes.
    - 1) Control-Valve Actuator: Paddle.
    - 2) Receptor: stainless-steel bowl.

## 2.3 WATER-TEMPERING EQUIPMENT

- A. Water-Tempering Equipment:
  - 1. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
    - a. Bradley Corporation.
    - b. Chicago Faucets.
    - c. Encon Safety Products.
    - d. Guardian Equipment Co.
    - e. Haws Corporation.
    - f. Lab Safety Supply Inc.
    - g. Murdock, Inc.
    - h. Sellstrom Manufacturing Co.
    - i. Speakman Company.
    - j. WaterSaver Faucet Co.
    - k. Western Emergency Equipment.
  - 2. Description: Factory-fabricated, hot- and cold-water-tempering equipment with thermostatic mixing valve.
    - a. Thermostatic Mixing Valve: Designed to provide 65 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Valves are specified in Division 15 Section "Valves."
  - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency plumbing fixture.
  - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install shutoff valve and strainer in steam piping and shutoff valve in condensate return piping.
- F. Install dielectric fitting in supply piping to fixture if piping and fixture connections are made of different metals. Dielectric fittings are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- G. Install thermometers in supply and outlet piping connections to water-tempering equipment. Thermometers are specified in Division 15 Section "Meters and Gages."
- H. Install trap and waste to wall on drain outlet of fixture receptors that are indicated to be directly connected to drainage system.
- I. Install indirect waste piping to wall on drain outlet of fixture receptors that are indicated to be indirectly connected to drainage system. Drainage piping is specified in Division 15 Section "Sanitary Waste and Vent Piping."
- J. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Escutcheons are specified in Division 15 Section "Basic Mechanical Materials and Methods."
- K. Install equipment nameplates or equipment markers on fixtures and equipment signs on water-tempering equipment. Identification materials are specified in Division 15 Section "Mechanical Identification."
- L. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- M. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment.
- N. Connect hot- and cold-water-supply piping to hot- and cold-water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures.

- O. Directly connect emergency plumbing fixture receptors with trapped drain outlet to sanitary drainage and vent piping.
- P. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary or storm drainage piping.
- Q. Adjust or replace fixture flow regulators for proper flow.
- R. Adjust equipment temperature settings.

**END OF SECTION 15412**

## **SECTION 15441**

### **DOMESTIC WATER PUMPS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes the following all-bronze and bronze-fitted centrifugal pumps for domestic cold- and hot-water circulation:
  - 1. Close-coupled, in-line, sealless centrifugal pumps.
- B. See Division 2 Section "Water Supply Wells" for well pumps.
- C. See Division 15 Section "Packaged Booster Pumps" for booster systems.

##### **1.2 SUBMITTALS**

- A. Product Data: For each type and size of domestic water pump specified. Include certified performance curves with operating points plotted on curves; and rated capacities of selected models, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.

##### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

#### **PART 2 - PRODUCTS**

##### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

## 2.2 CLOSE-COUPLED, IN-LINE, SEALLESS CENTRIFUGAL PUMPS

### A. Available Manufacturers:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Industries.
3. Grundfos Pumps Corp.
4. Taco, Inc.

### B. Description: Factory-assembled and -tested, single-stage, close-coupled, in-line, sealless centrifugal pumps as defined in HI 5.1-5.6.

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge-type unit with motor and impeller on common shaft and designed for installation with pump and motor shaft mounted horizontally.
2. Casing: Bronze, with threaded companion-flange connections.
3. Impeller: Corrosion-resistant material.
4. Motor: Single speed, unless otherwise indicated. Comply with requirements in Division 15 Section "Motors."

### C. Capacities and Characteristics:

1. As scheduled on the drawings

## 2.3 CONTROLS

### A. Thermostats: Electric; adjustable for control of hot-water circulation pump.

#### 1. Available Manufacturers:

- a. Honeywell International, Inc.
- b. Square D.
- c. White-Rodgers Div.; Emerson Electric Co.

2. Type: Water-immersion sensor, for installation in hot-water circulation piping.
3. Range: 65 to 200 deg F.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Settings: Start pump at 120 deg F and stop pump at 135 deg F.

### B. Timers: Electric time clock for control of hot-water circulation pump.

#### 1. Available Manufacturers:

- a. Honeywell International, Inc.
- b. Intermatic, Inc.
- c. Johnson Controls, Inc.
- d. Maple Chase Company.
- e. TORK.

2. Type: Programmable, [seven-day] <Insert other> clock with manual override on-off switch.
3. Enclosure: Suitable for wall mounting.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Programmable Sequence of Operation: Up to two on-off cycles each day for seven days.

## 2.4 FLEXIBLE CONNECTORS

### A. Available Manufacturers:

1. Anamet, Inc.
2. Flex-Hose Co., Inc.
3. Flexicraft Industries.
4. Flex-Pression, Ltd.
5. Flex-Weld, Inc.
6. Hyspan Precision Products, Inc.
7. Mercer Rubber.
8. Metraflex, Inc.
9. Proco Products, Inc.
10. Tozen America Corporation.
11. Unaflex Inc.

- B. Description: Corrugated, bronze inner tubing covered with bronze wire braid. Include copper-tube ends or bronze flanged ends, braze-welded to tubing. Include 125-psig minimum working-pressure rating and ends matching pump connections.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps with access for periodic maintenance including removal of motors, impellers, couplings, and accessories.
- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Install in-line, sealless] centrifugal pumps with motor and pump shafts horizontal.
- E. Install continuous-thread hanger rods and elastomeric hangers of sufficient size Mechanical Vibration to support pump weight. Vibration isolation devices are specified in Division 15 Section " and Seismic Controls." Fabricate brackets or supports as required. Hanger and support materials are specified in Division 15 Section "Hangers and Supports."
- F. Install immersion-type thermostats in hot-water return piping.
- G. Install timers.

- H. Piping installation requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- I. Install piping adjacent to pumps to allow service and maintenance.
- J. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles. Refer to Division 15 Section "Domestic Water Piping."
  - 1. Install flexible connectors adjacent to pumps in suction and discharge piping of close-coupled, horizontally mounted, in-line centrifugal pumps.
  - 2. Install shutoff valve and strainer on suction side of pumps, and check valve and throttling valve on discharge side of pumps. Install valves same size as connected piping. Refer to Division 15 Section "Valves" for general-duty valves for domestic water piping and Division 15 Section "Plumbing Specialties" for strainers.
  - 3. Install pressure gages at suction and discharge of pumps. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Refer to Division 15 Section "Meters and Gages" for pressure gages and gage connectors.
- K. Ground equipment according to Division 16 Section "Grounding and Bonding."
- L. Connect wiring according to Division 16 Section "Conductors and Cables."
- M. Connect thermostats and timers to pumps that they control.

**END OF SECTION 15441**

## **SECTION 15485**

### **ELECTRIC WATER HEATERS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Light-commercial electric water heaters.
  - 2. Water heater accessories.

##### **1.2 SUBMITTALS**

- A. Product Data: For each type and size of water heater indicated. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Operation and maintenance data.
- D. Warranty.

##### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- C. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9" for all components that will be in contact with potable water.

##### **1.4 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of electric water heaters that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including storage tank and supports.



- b. Faulty operation of controls.
  - c. Deterioration of metals, metal finishes, and other materials beyond normal use.
- 2. Warranty Period(s): From date of Substantial Completion:
  - a. Commercial Electric Water Heaters: Three years.

## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

### **2.2 LIGHT-COMMERCIAL ELECTRIC WATER HEATERS**

- A. Description: Comply with UL 174 for household, storage electric water heaters.
  - 1. Available Manufacturers:
    - a. American Water Heater Company.
    - b. Bradford White Corporation.
    - c. Electric Heater Company (The); Hubbell Heaters Division.
    - d. GSW Water Heating Company.
    - e. Heat Transfer Products, Inc.
    - f. Lochinvar Corporation.
    - g. Rheem Water Heater Div.; Rheem Manufacturing Company.
    - h. Ruud Water Heater Div.; Rheem Manufacturing Company.
    - i. Smith, A. O. Water Products Company.
    - j. State Industries, Inc.
  - 2. Storage-Tank Construction: Steel, vertical arrangement.
    - a. Tappings: ASME B1.20.1 pipe thread.
    - b. Pressure Rating: 150 psig.
    - c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending lining material into tappings.
  - 3. Factory-Installed Storage-Tank Appurtenances:
    - a. Anode Rod: Replaceable magnesium.
    - b. Dip Tube: Provide unless cold-water inlet is near bottom of tank.
    - c. Drain Valve: ASSE 1005.
    - d. Insulation: Comply with ASHRAE/IESNA 90.1 or ASHRAE 90.2.
    - e. Jacket: Steel with enameled finish.

- f. Heat Trap Fittings: Inlet type in cold-water inlet and outlet type in hot-water outlet.
  - g. Heating Elements: Two; electric, screw-in immersion type; wired for simultaneous operation, unless otherwise indicated.
  - h. Temperature Control: Adjustable thermostat for each element.
  - i. Safety Control: High-temperature-limit cutoff device or system.
  - j. Relief Valve: ASME rated and stamped and complying with ASME PTC 25.3 for combination temperature and pressure relief valves. Include relieving capacity at least as great as heat input, and include pressure setting less than water heater working-pressure rating. Select relief valve with sensing element that extends into storage tank.
- 4. Special Requirements: NSF 5 construction with legs for off-floor installation.
- 5. Capacity and Characteristics:
  - a. As scheduled on the drawings.

## 2.3 WATER HEATER ACCESSORIES

- A. Water Heater Stands: Water heater manufacturer's factory-fabricated steel stand for floor mounting and capable of supporting water heater and water. Include dimension that will support bottom of water heater a minimum of 18 inches above the floor.
- B. Water Heater Mounting Brackets: Water heater manufacturer's factory-fabricated steel bracket for wall mounting and capable of supporting water heater and water.
- C. Drain Pans: Corrosion-resistant metal with raised edge. Include dimensions not less than base of water heater and include drain outlet not less than NPS 3/4.
- D. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.
- E. Water Regulators: ASSE 1003, water-pressure reducing valve. Set at 25-psig- maximum outlet pressure, unless otherwise indicated.
- F. Shock Absorbers: ASSE 1010 or PDI WH 201, Size A water hammer arrester.

## PART 3 - EXECUTION

### 3.1 WATER HEATER INSTALLATION

- A. Install commercial water heaters on concrete bases.
  - 1. Exception: Omit concrete bases for commercial water heaters if installation on stand, bracket, suspended platform, or direct on floor is indicated.
  - 2. Concrete base construction requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

- B. Install water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- C. Install combination temperature and pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial, water-heater, relief-valve outlet, with drain piping same as domestic water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- D. Install water heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for water heaters that do not have tank drains. Refer to Division 15 Section "Plumbing Specialties" for hose-end drain valves.
- E. Install thermometer on outlet piping of water heaters. Refer to Division 15 Section "Meters and Gages" for thermometers.
- F. Install water regulator, with integral bypass relief valve, in booster-heater inlet piping and water hammer arrester in booster-heater outlet piping.
- G. Install piping-type heat traps on inlet and outlet piping of water heater storage tanks without integral or fitting-type heat traps.
- H. Fill water heaters with water.

### 3.2 CONNECTIONS

- A. Install piping adjacent to water heaters to allow service and maintenance. Arrange piping for easy removal of water heaters.
- B. Ground equipment according to Division 16 Section "Grounding and Bonding."
- C. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.3 FIELD QUALITY CONTROL

- A. Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections.
- B. Perform the following field tests and inspections:
  - 1. Leak Test: After installation, test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Operational Test: After electrical circuitry has been energized, confirm proper operation.
  - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace water heaters that do not pass tests and inspections and retest as specified above.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial electric water heaters. Refer to Division 1 Section "Demonstration and Training."

**END OF SECTION 15485**

## **SECTION 15543**

### **WASTE OIL-FIRED UNIT HEATERS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes waste oil fired unit heaters.

##### **1.2 SUBMITTALS**

- A. Product Data: For each type of fuel-fired unit heater indicated. Include rated capacities, operating characteristics, and accessories.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  - 1. Wiring Diagrams: Power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

##### **1.3 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

##### **1.4 WARRANTY**

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace heat exchanger of fuel-fired unit heater that fails in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 WASTE OIL-FIRED UNIT HEATERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings.
- B. Description: Factory assembled, piped, and wired, and complying with UL 731.
- C. Housing: Steel, with inserts for suspension mounting rods.
- D. Heat Exchanger: Stainless steel.
- E. Burners: Flame-retention, pressure-atomizing, forced-draft, gun type; with integral fuel pump and electronic spark ignition and flame safety.
  - 1. Safety Device: Oil-pressure switch.
- F. Unit Fan: Squirrel cage fan with blades dynamically balanced and resiliently mounted.
- G. Controls: Factory piped and prewired to electrical junction box mounted on unit, including the following:
  - 1. Control Transformer: Integrally mounted, 120 to 24 V ac.
  - 2. Cad-cell safety system.
  - 3. Manual reset safety.
  - 4. Thermostat: 7-day programmable, 24-V ac, wall-mounting type with 50 to 90 deg F operating range and fan on switch.
- H. Automatic Fan Thermal Switch: Fan operates with heat-exchanger temperature more than 135 deg F.
- I. Accessories:
  - 1. Vertical discharge louvers.
  - 2. Heating Center heater support and storage tank with
    - a. Metal furnace stand and legs.
    - b. 250 gallon storage tank.
    - c. Filter drain pan.
    - d. Pump mounting bracket
    - e. 4" tank emergency vent with weather resistant breather.
    - f. Copper fuel oil tubing and fittings to connect the furnace.
    - g. Low oil cutoff switch
- J. Capacities and Characteristics:
  - 1. As scheduled on the drawings

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Install and connect oil-fired unit heaters and associated fuel and vent piping according to NFPA 31, applicable local codes and regulations, and manufacturer's written installation instructions.
- B. Install piping adjacent to fuel-fired unit heater to allow service and maintenance.
- C. Vent Connections: Comply with Division 15 Section "Breechings, Chimneys, and Stacks."
- D. Electrical Connections: Comply with applicable requirements in Division 16 Sections.
  - 1. Install electrical devices furnished with heaters but not specified to be factory mounted.
- E. Adjust initial temperature set points.
- F. Adjust burner and other unit components for optimum heating performance and efficiency.

### **3.2 FIELD QUALITY CONTROL**

- A. Tests and Inspections: Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 15543**

## **SECTION 15550**

### **BREECHINGS, CHIMNEYS, AND STACKS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes the following:
  - 1. Listed double-wall vents.
- B. See Division 15 Section "Draft Control Devices" for induced-draft and mechanical fans and for motorized and barometric dampers.

##### **1.2 SUBMITTALS**

- A. Product Data: For the following:
  - 1. Type L vents.
- B. Shop Drawings: For vents, breechings, chimneys, and stacks. Include plans, elevations, sections, details, and attachments to other work.

#### **PART 2 - PRODUCTS**

##### **2.1 LISTED TYPE L VENTS**

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. American Metal Products; MASCO Corporation.
  - 2. FAMCO.
  - 3. Heat-Fab, Inc.
  - 4. Industrial Chimney Company.
  - 5. LSP Products Group, Inc.
  - 6. Metal-Fab, Inc.
  - 7. Schebler Co. (The).
  - 8. Selkirk Inc.; Selkirk Metalbestos and Air Mate.
  - 9. Simpson Dura-Vent Co., Inc.; Subsidiary of Simpson Manufacturing Co.
  - 10. Tru-Flex Metal Hose Corp.
  - 11. Van-Packer Company, Inc.
- B. Description: Double-wall metal vents tested according to UL 641 and rated for 570 deg F continuously, or 1700 deg F for 10 minutes; with neutral or negative flue pressure complying with NFPA 211.



- C. Construction: Inner shell and outer jacket separated by at least a 1-inch airspace filled with high-temperature, ceramic-fiber or mineral-wool insulation.
- D. Inner Shell: ASTM A 666, Type 304 or Type 316 stainless steel.
- E. Outer Jacket: Galvanized steel.
- F. Accessories: Tees, elbows, increasers, draft-hood connectors, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly.
  - 1. Termination: Round chimney top designed to exclude 98 percent of rainfall.

### **PART 3 - EXECUTION**

#### **3.1 APPLICATION**

- A. Listed Type L Vents: Vents for waste oil burners.

#### **3.2 INSTALLATION OF LISTED VENTS AND CHIMNEYS**

- A. Locate to comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211, whichever is most stringent.
- B. Support vents at intervals recommended by manufacturer to support weight of vents and all accessories, without exceeding appliance loading.
- C. Slope breechings down in direction of appliance, with condensate drain connection at lowest point piped to nearest drain.
- D. Lap joints in direction of flow.
- E. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finishes.
- F. Clean breechings internally, during and after installation, to remove dust and debris. Clean external surfaces to remove welding slag and mill film. Grind welds smooth and apply touchup finish to match factory or shop finish.
- G. Provide temporary closures at ends of breechings, chimneys, and stacks that are not completed or connected to equipment.

**END OF SECTION 15550**

## **SECTION 15762**

### **UNIT HEATERS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

###### **A. Section Includes:**

1. Propeller unit heaters with electric-resistance heating coils.
2. Wall and ceiling heaters with propeller fans and electric-resistance heating coils.

##### **1.2 SUBMITTALS**

###### **A. Product Data:** Include rated capacities, operating characteristics, furnished specialties, and accessories for each product indicated.

###### **B. Shop Drawings:** Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Plans, elevations, sections, and details.
2. Location and size of each field connection.
3. Equipment schedules to include rated capacities, furnished specialties, and accessories.

###### **C. Field quality-control test reports.**

###### **D. Operation and maintenance data.**

##### **1.3 QUALITY ASSURANCE**

###### **A. Electrical Components, Devices, and Accessories:** Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

#### **PART 2 - PRODUCTS**

##### **2.1 EXPLOSION PROOF PROPELLER UNIT HEATERS**

###### **A. Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

###### **B. Manufacturers:** Subject to compliance with requirements, provide products by one of the following:

1. Airtherm; a Mestek Company.
  2. Engineered Air Ltd.
  3. McQuay International.
  4. Rosemex Products.
  5. Ruffneck Heaters; a division of Lexa Corporation.
  6. Trane.
- C. Description: An assembly including casing, coil, fan, and motor in horizontal discharge configuration with adjustable discharge louvers. Entire assembly shall be explosion proof constructed.
- D. Comply with UL 2021.
- E. Cabinet: Removable panels for maintenance access to controls.
- F. Cabinet Finish: Manufacturer's standard baked enamel applied to factory-assembled and -tested propeller unit heater before shipping.
- G. Discharge Louver: Adjustable fin diffuser for horizontal units and conical diffuser for vertical units.
- H. Electric-Resistance Heating Elements: Liquid-to-air design with all welded steel headers and finned tube construction with spiral wound aluminum fins. Heating elements to be immersed in a nontoxic, inhibited, propylene glycol heat transfer fluid that provides freeze protection down to -49°F (-45°C). The heat exchanger shall be hydrostatically tested at 350 psig. A pressure relief valve shall provide excess pressure protection and is set at 70 psig
- I. Circuit Protection: One-time fuses in terminal box for overcurrent protection and limit controls for high-temperature protection of heaters.
1. Wiring Terminations: Stainless-steel or corrosion-resistant material.
- J. Fan: Propeller type with aluminum wheel directly mounted on motor shaft in the fan venturi.
- K. Fan Motors: Comply with requirements in "Division 15 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Type: Explosion proof.

## 2.2 WALL AND CEILING HEATERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
1. Berko Electric Heating; a division of Marley Engineered Products.
  2. Chromalox, Inc.; a division of Emerson Electric Company.
  3. Indeeco.
  4. Markel Products; a division of TPI Corporation.
  5. Marley Electric Heating; a division of Marley Engineered Products.
  6. Ouellet Canada Inc.
  7. QMark Electric Heating; a division of Marley Engineered Products.

- 8. Trane.
- B. Description: An assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.
- C. Cabinet:
  - 1. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.
  - 2. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.
- D. Surface-Mounting Cabinet Enclosure: Steel with finish to match cabinet.
- E. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high temperature protection. Provide integral circuit breaker for overcurrent protection.
- F. Fan: Aluminum propeller directly connected to motor.
  - 1. Motor: Permanently lubricated. Comply with requirements in Division 15 Section "Common Motor Requirements for HVAC Equipment."
- G. Controls: Low-voltage relay with transformer kit.
- H. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.
- I. Capacities and Characteristics:
  - 1. As scheduled on the drawings

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Install unit heaters to comply with NFPA 90A.
- B. Suspend propeller unit heaters from structure with all-thread hanger rods. Hanger rods and attachments to structure are specified in Division 15 Section "Hangers and Supports for HVAC Piping and Equipment." Vibration hangers are specified in Division 15 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install wall-mounting thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

- D. Ground equipment according to Division 16 Section "Grounding and Bonding."
- E. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
  - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
  - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Remove and replace malfunctioning units and retest as specified above.

**END OF SECTION 15762**

## **SECTION 15815**

### **METAL DUCTS**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes metal, rectangular ducts and fittings for supply, return, outside, and exhaust air-distribution systems in pressure classes from minus 2- to plus 10-inch wg.
- B. See Division 15 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

##### **1.2 SUBMITTALS**

- A. Shop Drawings: Show fabrication and installation details for metal ducts.
  - 1. Penetrations through fire-rated and other partitions.
  - 2. Duct accessories, including access doors and panels.

##### **1.3 QUALITY ASSURANCE**

- A. NFPA Compliance:
  - 1. NFPA 90A, "Installation of Air Conditioning and Ventilating Systems."
  - 2. NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

#### **PART 2 - PRODUCTS**

##### **2.1 MANUFACTURERS**

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

##### **2.2 SHEET METAL MATERIALS**

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise

indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G90 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts.
- D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

## 2.3 SEALANT MATERIALS

- A. Joint and Seam Tape: 2 inches wide; glass-fiber-reinforced fabric.
- B. Tape Sealing System: Woven-fiber tape impregnated with gypsum mineral compound and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
- C. Water-Based Joint and Seam Sealant: Flexible, adhesive sealant, resistant to UV light when cured, UL 723 listed, and complying with NFPA requirements for Class 1 ducts.
- D. Solvent-Based Joint and Seam Sealant: One-part, nonsag, solvent-release-curing, polymerized butyl sealant formulated with a minimum of 75 percent solids.
- E. Flanged Joint Mastic: One-part, acid-curing, silicone, elastomeric joint sealant complying with ASTM C 920, Type S, Grade NS, Class 25, Use O.
- F. Flange Gaskets: Butyl rubber or EPDM polymer with polyisobutylene plasticizer.

## 2.4 HANGERS AND SUPPORTS

- A. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
  - 2. Exception: Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- B. Hanger Materials: Galvanized sheet steel or threaded steel rod.
  - 1. Hangers Installed in Corrosive Atmospheres: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
  - 2. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for steel sheet width and thickness and for steel rod diameters.

- C. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- D. Trapeze and Riser Supports: Galvanized-steel shapes and plates complying with ASTM A 36/A 36M.

## 2.5 RECTANGULAR DUCT FABRICATION

- A. Fabricate ducts, elbows, transitions, offsets, branch connections, and other construction according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" and complying with requirements for metal thickness, reinforcing types and intervals, tie-rod applications, and joint types and intervals.
  - 1. Lengths: Fabricate rectangular ducts in lengths appropriate to reinforcement and rigidity class required for pressure class.
  - 2. Deflection: Duct systems shall not exceed deflection limits according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible."
- B. Transverse Joints: Prefabricated slide-on joints and components constructed using manufacturer's guidelines for material thickness, reinforcement size and spacing, and joint reinforcement.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Nexus Inc.
    - c. Ward Industries, Inc.
- C. Formed-On Flanges: Construct according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," Figure 1-4, using corner, bolt, cleat, and gasket details.
  - 1. Manufacturers:
    - a. Ductmate Industries, Inc.
    - b. Lockformer.
  - 2. Duct Size: Maximum 30 inches wide and up to 2-inch wg pressure class.
  - 3. Longitudinal Seams: Pittsburgh lock sealed with noncuring polymer sealant.
- D. Cross Breaking or Cross Beading: Cross break or cross bead duct sides 19 inches and larger and 0.0359 inch thick or less, with more than 10 sq. ft. of nonbraced panel area unless ducts are lined.

## PART 3 - EXECUTION

### 3.1 DUCT APPLICATIONS

- A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:



1. Supply Ducts: 1-inch wg.
2. Exhaust Ducts (Negative Pressure): 2-inch wg.

### 3.2 DUCT INSTALLATION

- A. Construct and install ducts according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
- B. Install ducts with fewest possible joints.
- C. Install fabricated fittings for changes in directions, size, and shape and for connections.
- D. Install couplings tight to duct wall surface with a minimum of projections into duct. Secure couplings with sheet metal screws. Install screws at intervals of 12 inches, with a minimum of 3 screws in each coupling.
- E. Install ducts, unless otherwise indicated, vertically and horizontally and parallel and perpendicular to building lines; avoid diagonal runs.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.
- H. Conceal ducts from view in finished spaces. Do not encase horizontal runs in solid partitions unless specifically indicated.
- I. Coordinate layout with suspended ceiling, fire- and smoke-control dampers, lighting layouts, and similar finished work.
- J. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.
- K. Electrical Equipment Spaces: Route ducts to avoid passing through transformer vaults and electrical equipment spaces and enclosures.
- L. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
- M. Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls, install appropriately rated fire dampers, sleeves, and firestopping sealant. Fire and smoke dampers are specified in Division 15 Section "Duct Accessories." Firestopping materials and installation methods are specified in Division 7 Section "Through-Penetration Firestop Systems."
- N. Protect duct interiors from the elements and foreign materials until building is enclosed. Follow SMACNA's "Duct Cleanliness for New Construction."

### 3.3 SEAM AND JOINT SEALING

- A. Seal duct seams and joints according to SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for duct pressure class indicated.
  - 1. For pressure classes lower than 2-inch wg, seal transverse joints.
- B. Seal ducts before external insulation is applied.

### 3.4 HANGING AND SUPPORTING

- A. Support horizontal ducts within 24 inches of each elbow and within 48 inches of each branch intersection.
- B. Support vertical ducts at maximum intervals of 16 feet and at each floor.
- C. Install upper attachments to structures with an allowable load not exceeding one-fourth of failure (proof-test) load.
- D. Install concrete inserts before placing concrete.
- E. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 1. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors according to Division 15 Section "Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

**END OF SECTION 15815**

**SECTION 15838**  
**POWER VENTILATORS**

**PART 1 - GENERAL**

1.1 SUMMARY

- A. This Section includes the following:
  - 1. Utility Set Fans.
  - 2. Ceiling-mounting ventilators.
  - 3. Propeller fans.

1.2 SUBMITTALS

- A. Product Data: Include rated capacities, furnished specialties, and accessories for each type of product indicated and include the following:
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NEMA Compliance: Motors and electrical accessories shall comply with NEMA standards.
- C. UL Standard: Power ventilators shall comply with UL 705.

**PART 2 - PRODUCTS**

2.1 UTILITY SET FANS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Aerovent; a division of Twin City Fan Companies, Ltd.
  2. Breidert Air Products.
  3. Carnes Company.
  4. Hartzell Fan Incorporated.
  5. JencoFan.
  6. Loren Cook Company.
  7. New York Blower Company (The).
  8. PennBarry.
  9. Quietaire Inc.
  10. Trane; a business of American Standard Companies.
- C. Housing: Fabricated of [ steel with side sheets fastened with a deep lock seam or welded to scroll sheets.
1. Housing Discharge Arrangement: Adjustable to eight standard positions.
- D. Fan Wheels: Single-width, single inlet; welded to cast-iron or cast-steel hub and spun-steel inlet cone, with hub keyed to shaft.
1. Blade Materials: Aluminum.
  2. Blade Type: [Backward inclined] [Forward curved] [Airfoil].
  3. Spark-Resistant Construction: AMCA 99, Type B.
- E. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
- F. Shaft Bearings: Pre-lubricated and sealed, self-aligning, pillow-block-type ball bearings with ABMA 9, L<sub>50</sub> of 200,000 hours.
1. Extend grease fitting to accessible location outside of unit.
  2. Shaft seal shall be aluminum.
  3. Rub ring shall be aluminum.
- G. Motors:
1. Refer to 15 section "Motors" for general motor requirements.
  2. Motor shall be sized for fan rpm operation with VFD, not power line Hz.
  3. Motor shall have class B or greater insulation
- H. Controls:
1. Field power supply 1 phase, microdrive converted to 3 phase.
  2. VFD with button interface for balancing.
  3. Constant pressure control with integral transducer and two pressure inputs.
  4. Control transformer 277VAC to 24 VDC, mounted and wired.
- I. Accessories:
1. Inlet and Outlet: Flanged.
  2. Companion Flanges: Rolled flanges for duct connections of same material as housing.
  3. Access Door: Gasketed door with bolted closure.
  4. Drain Connections: 1" threaded coupling drain connection installed at lowest point of housing.
  5. Weather Hoods: Weather resistant with stamped vents over motor and drive compartment.
  6. Hi-Pro polyester coating on fan and attached accessories in factory standard color.

- J. Capacities and Characteristics:
  - 1. As scheduled on the drawings.
  - 2. Electrical Characteristics:
    - a. Volts: 240.
    - b. Phase: 1.
    - c. Hertz: 60.
  - 3. Vibration Isolators:
    - a. Type: Spring isolators.
    - b. Static Deflection: 1 inches.
  - 4. Spark Arrestance Class: B.

## 2.2 CEILING-MOUNTING VENTILATORS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:
  - 1. American Coolair Corp.
  - 2. Ammerman; General Resource Corp.
  - 3. Breidert Air Products.
  - 4. Broan Mfg. Co., Inc.
  - 5. Carnes Company HVAC.
  - 6. Dayton Electric Manufacturing Co.; a division of W. W. Grainger, Inc.
  - 7. FloAire.
  - 8. Greenheck.
  - 9. JencoFan; Div. of Breidert Air Products.
  - 10. Loren Cook Company.
  - 11. NuTone Inc.
  - 12. Penn Ventilation.
- B. Description: Centrifugal fans designed for installing in ceiling or wall or for concealed in-line applications.
- C. Housing: Steel, lined with acoustical insulation.
- D. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.
- E. Grille: Plastic or Aluminum, louvered grille with flange on intake and thumbscrew attachment to fan housing.
- F. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.
- G. Accessories:
  - 1. Fan speed control mounted in fan housing.
  - 2. Motion Sensor: Motion detector with adjustable shutoff timer.
  - 3. Manufacturer's standard wall cap, and transition fittings.

## 2.3 PROPELLER FANS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
1. Acme Engineering & Manufacturing Corporation.
  2. Aerovent; a division of Twin City Fan Companies, Ltd.
  3. Breidert Air Products.
  4. Carnes Company.
  5. Chicago Blower Corporation.
  6. Hartzell Fan Incorporated.
  7. JencoFan.
  8. Loren Cook Company.
  9. New York Blower Company (The).
  10. PennBarry.
  11. Quietaire Inc.
- B. Housing: Galvanized-steel sheet with flanged edges and integral orifice ring with baked-enamel finish coat applied after assembly.
- C. Steel Fan Wheels: Formed-steel blades riveted to heavy-gage steel spider bolted to cast-iron hub.
- D. Fan Drive: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.
- E. Fan Drive:
1. Resiliently mounted to housing.
  2. Statically and dynamically balanced.
  3. Selected for continuous operation at maximum rated fan speed and motor horsepower, with final alignment and belt adjustment made after installation.
  4. Extend grease fitting to accessible location outside of unit.
  5. Service Factor Based on Fan Motor Size: 1.4.
  6. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
  7. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
    - a. Ball-Bearing Rating Life: ABMA 9,  $L_{10}$  of 100,000 hours.
  8. Pulleys: Cast iron with split, tapered bushing; dynamically balanced at factory.
  9. Motor Pulleys: Adjustable pitch for use with motors through 5 hp; fixed pitch for use with larger motors. Select pulley so pitch adjustment is at the middle of adjustment range at fan design conditions.
  10. Belts: Oil resistant, nonsparking, and nonstatic; matched sets for multiple belt drives.
  11. Belt Guards: Fabricate of steel for motors mounted on outside of fan cabinet.
- F. Accessories:
1. Gravity Shutters: Aluminum blades in aluminum frame; interlocked blades with nylon bearings.

2. Motor-Side Back Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.
3. Wall Sleeve: Galvanized steel to match fan and accessory size.
4. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.

G. Capacities and Characteristics:

1. As scheduled on the drawings.

## 2.4 MOTORS

- A. Comply with requirements in Division 15 Section "Motors."
- B. Enclosure Type: Totally enclosed, fan cooled.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install power ventilators level and plumb.
- B. Support units using spring isolators having a static deflection of 1 inch.
  1. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
- C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.
- D. Install units with clearances for service and maintenance.
- E. Label units according to requirements specified in Division 15 Section "Mechanical Identification."
- F. Duct installation and connection requirements are specified in other Division 15 Sections. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Division 15 Section "Duct Accessories."
- G. Install ducts adjacent to power ventilators to allow service and maintenance.
- H. Ground equipment according to Division 16 Section "Grounding and Bonding."
- I. Connect wiring according to Division 16 Section "Conductors and Cables."

### 3.2 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:

1. Verify that shipping, blocking, and bracing are removed.
  2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
  3. Verify that cleaning and adjusting are complete.
  4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
  5. Adjust belt tension.
  6. Adjust damper linkages for proper damper operation.
  7. Verify lubrication for bearings and other moving parts.
  8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
  9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
  10. Shut unit down and reconnect automatic temperature-control operators.
  11. Remove and replace malfunctioning units and retest as specified above.
- B. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

**END OF SECTION 15838**



## SECTION 15900

### CONTROLS AND INSTRUMENTATION

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. Section Includes Control Of:
  - 1. Split System Air Conditioners
  - 2. Electric Duct Coils
  - 3. Makeup Air Units.
  - 4. Exhaust Fans
  - 5. Electric Wall Heater
  - 6. Electric Unit Heaters
- B. Intent of this section is for the Make Up Air Unit and Exhaust fan to be controlled by the Programmable Logic Control System. The furnaces shall be controlled locally with programmable thermostats.
- C. Related Sections:
  - 1. Section 15050 – Testing, Adjusting, and Balancing. For HVAC
  - 2. Section 15838 – Power Ventilators
  - 3. Section 15562 – Unfired Makeup Air Units

##### 1.02 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacture and installation of automatic controls system with three years' experience.

##### 1.03 SUBMITTALS

- A. Submit shop drawings and product data to requirements of Division 1.
- B. Indicate on shop drawings, complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Include sizing as requested.
- C. Provide product data on each control component.
- D. At completion of work, make detailed check out of automatic control system and submit written report.

## **PART 2 - PRODUCTS**

### **2.01 DAMPERS**

- A. Dampers: 16 ga stainless steel multiple blade mounted in 12 ga stainless steel flanged frame. Individual blades shall not exceed 6 inches in width or 48 inches in length with interlocking edges and compressible seals. Provide oil impregnated bronze or nylon bearings with additional thrust bearings for vertical blades.
- B. Provide mixing dampers of opposed blade construction arranged to mix streams. Dampers shall have maximum 1 percent leakage at 6 inch s.p.

### **2.02 DAMPER OPERATORS**

- A. Gear driven type with spring return to open or close position as governed by freeze, fire or temperature protection. Provide pilot positioners when sequenced with other actuators.

### **2.03 CONTROL PANELS**

- A. One cabinet may accommodate more than one system in same equipment room.
- B. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved phenolic nameplates on cabinet face.

## **PART 3 - EXECUTION**

### **3.01 INSTALLATION**

- A. Check and verify location of thermostats, and other exposed control sensors with plans and rooms details before installation.
- B. Install 'hand-off-auto' selector switches such that only automatic interlock controls and not safety controls and electrical over-current protection shall be overridden when switch is in the 'hand position.
- C. Provide conduit and electrical wiring to Division 16 requirements. Locate conduit with floor and structural elements in manner consistent with electrical installation.
- D. At completion of installation, provide minimum of one day instruction period for operating personnel.
- E. Install thermostats where indicated.

**END OF SECTION 15900**

## **SECTION 15950**

### **TESTING, ADJUSTING, AND BALANCING**

#### **PART 1 - GENERAL**

##### **1.1 SUMMARY**

- A. This Section includes TAB to produce design objectives for the following:
  - 1. Air Systems:
    - a. Constant-volume air systems.
  - 2. Plumbing Hot Water Piping Systems:
    - a. Constant-flow systems.
  - 3. HVAC equipment quantitative-performance settings.
  - 4. Verifying that automatic control devices are functioning properly.
  - 5. Reporting results of activities and procedures specified in this Section.

##### **1.2 SUBMITTALS**

- A. Strategies and Procedures Plan: Within **30** days from Contractor's Notice to Proceed, submit 1 copies of TAB strategies and step-by-step procedures as specified in Part 3 "Preparation" Article. Include a complete set of report forms intended for use on this Project.
- B. Certified TAB Reports: Submit two copies of reports prepared, as specified in this Section, on approved forms certified by TAB firm.
- C. Warranties specified in this Section.

##### **1.3 QUALITY ASSURANCE**

- A. TAB Firm Qualifications: Engage a TAB firm certified by.
- B. Certification of TAB Reports: Certify TAB field data reports. This certification includes the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that TAB team complied with approved TAB plan and the procedures specified and referenced in this Specification.

- C. TAB Report Forms: Use standard forms from AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems." or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems."

#### 1.4 PROJECT CONDITIONS

- A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### 1.5 COORDINATION

- A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist TAB activities.
- B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

#### 1.6 WARRANTY

- A. National Project Performance Guarantee: Provide a guarantee on AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" forms stating that AABC will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee includes the following provisions:
- B. Special Guarantee: Provide a guarantee on NEBB forms stating that NEBB will assist in completing requirements of the Contract Documents if TAB firm fails to comply with the Contract Documents. Guarantee shall include the following provisions:
  - 1. The certified TAB firm has tested and balanced systems according to the Contract Documents.
  - 2. Systems are balanced to optimum performance capabilities within design and installation limits.

### **PART 2 - PRODUCTS (Not Applicable)**

### **PART 3 - EXECUTION**

#### 3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
  - 1. Verify that balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are required

by the Contract Documents. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation.

- B. Examine approved submittal data of HVAC systems and equipment.
- C. Examine Project Record Documents described in Division 1 Section "Project Record Documents."
- D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine equipment performance data including fan and pump curves. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA's "HVAC Systems-Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.
- F. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Sections have been performed.
- G. Examine system and equipment test reports.
- H. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.
- I. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.
- J. Examine HVAC equipment to ensure that clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- K. Examine terminal units, such as variable-air-volume boxes, to verify that they are accessible and their controls are connected and functioning.
- L. Examine plenum ceilings used for supply air to verify that they are airtight. Verify that pipe penetrations and other holes are sealed.
- M. Examine strainers for clean screens and proper perforations.
- N. Examine three-way valves for proper installation for their intended function of diverting or mixing fluid flows.
- O. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

- P. Examine system pumps to ensure absence of entrained air in the suction piping.
- Q. Examine equipment for installation and for properly operating safety interlocks and controls.
- R. Examine automatic temperature system components to verify the following:
  - 1. Dampers, valves, and other controlled devices are operated by the intended controller.
  - 2. Dampers and valves are in the position indicated by the controller.
  - 3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multizone units, mixing boxes, and variable-air-volume terminals.
  - 4. Automatic modulating and shutoff valves, including two-way valves and three-way mixing and diverting valves, are properly connected.
  - 5. Thermostats and humidistats are located to avoid adverse effects of sunlight, drafts, and cold walls.
  - 6. Sensors are located to sense only the intended conditions.
  - 7. Sequence of operation for control modes is according to the Contract Documents.
  - 8. Controller set points are set at indicated values.
  - 9. Interlocked systems are operating.
  - 10. Changeover from heating to cooling mode occurs according to indicated values.
- S. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.2 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system readiness checks and prepare system readiness reports. Verify the following:
  - 1. Permanent electrical power wiring is complete.
  - 2. Hydronic systems are filled, clean, and free of air.
  - 3. Automatic temperature-control systems are operational.
  - 4. Equipment and duct access doors are securely closed.
  - 5. Balance, smoke, and fire dampers are open.
  - 6. Isolating and balancing valves are open and control valves are operational.
  - 7. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 8. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems" or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and this Section.

- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing, close probe holes and patch insulation with new materials identical to those removed. Restore vapor barrier and finish according to insulation Specifications for this Project.
- C. Mark equipment and balancing device settings with paint or other suitable, permanent identification material, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, to show final settings.

### 3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.
- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct airflow measurements.
- E. Check airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling unit components.
- L. Check for proper sealing of air duct system.

### 3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
  - 1. Measure fan static pressures to determine actual static pressure as follows:
    - a. Measure outlet static pressure as far downstream from the fan as practicable and upstream from restrictions in ducts such as elbows and transitions.
    - b. Measure static pressure directly at the fan outlet or through the flexible connection.

- c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from flexible connection and downstream from duct restrictions.
    - d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.
  - 2. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.
    - a. Simulate dirty filter operation and record the point at which maintenance personnel must change filters.
  - 3. Measure static pressures entering and leaving other devices such as sound traps, heat recovery equipment, and air washers, under final balanced conditions.
  - 4. Compare design data with installed conditions to determine variations in design static pressures versus actual static pressures. Compare actual system effect factors with calculated system effect factors to identify where variations occur. Recommend corrective action to align design and actual conditions.
  - 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full cooling, full heating, economizer, and any other operating modes to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.
- 1. Measure static pressure at a point downstream from the balancing damper and adjust volume dampers until the proper static pressure is achieved.
    - a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.
  - 2. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.
- C. Measure terminal outlets and inlets without making adjustments.
- 1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.
- D. Adjust terminal outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using volume dampers rather than extractors and the dampers at air terminals.
- 1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
  - 2. Adjust patterns of adjustable outlets for proper distribution without drafts.



### 3.6 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports with pertinent design data and number in sequence starting at pump to end of system. Check the sum of branch-circuit flows against approved pump flow rate. Correct variations that exceed plus or minus 5 percent.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. Prepare hydronic systems for testing and balancing according to the following, in addition to the general preparation procedures specified above:
  - 1. Open all manual valves for maximum flow.
  - 2. Check expansion tank liquid level.
  - 3. Check makeup-water-station pressure gage for adequate pressure for highest vent.
  - 4. Check flow-control valves for specified sequence of operation and set at indicated flow.
  - 5. Set differential-pressure control valves at the specified differential pressure. Do not set at fully closed position when pump is positive-displacement type unless several terminal valves are kept open.
  - 6. Set system controls so automatic valves are wide open to heat exchangers.
  - 7. Check pump-motor load. If motor is overloaded, throttle main flow-balancing device so motor nameplate rating is not exceeded.
  - 8. Check air vents for a forceful liquid flow exiting from vents when manually operated.

### 3.7 PROCEDURES FOR HYDRONIC SYSTEMS

- A. Measure water flow at pumps. Use the following procedures, except for positive-displacement pumps:
  - 1. Verify impeller size by operating the pump with the discharge valve closed. Read pressure differential across the pump. Convert pressure to head and correct for differences in gage heights. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
  - 2. Check system resistance. With all valves open, read pressure differential across the pump and mark pump manufacturer's head-capacity curve. Adjust pump discharge valve until indicated water flow is achieved.
  - 3. Verify pump-motor brake horsepower. Calculate the intended brake horsepower for the system based on pump manufacturer's performance data. Compare calculated brake horsepower with nameplate data on the pump motor. Report conditions where actual amperage exceeds motor nameplate amperage.
  - 4. Report flow rates that are not within plus or minus 5 percent of design.
- B. Set calibrated balancing valves, if installed, at calculated presettings.
- C. Measure flow at all stations and adjust, where necessary, to obtain first balance.
  - 1. System components that have Cv rating or an accurately cataloged flow-pressure-drop relationship may be used as a flow-indicating device.
- D. Measure flow at main balancing station and set main balancing device to achieve flow that is 5 percent greater than indicated flow.

- E. Adjust balancing stations to within specified tolerances of indicated flow rate as follows:
  - 1. Determine the balancing station with the highest percentage over indicated flow.
  - 2. Adjust each station in turn, beginning with the station with the highest percentage over indicated flow and proceeding to the station with the lowest percentage over indicated flow.
  - 3. Record settings and mark balancing devices.
- F. Measure pump flow rate and make final measurements of pump amperage, voltage, rpm, pump heads, and systems' pressures and temperatures including outdoor-air temperature.
- G. Measure the differential-pressure control valve settings existing at the conclusions of balancing.

### 3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  - 1. Manufacturer, model, and serial numbers.
  - 2. Motor horsepower rating.
  - 3. Motor rpm.
  - 4. Efficiency rating.
  - 5. Nameplate and measured voltage, each phase.
  - 6. Nameplate and measured amperage, each phase.
  - 7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass for the controller to prove proper operation. Record observations, including controller manufacturer, model and serial numbers, and nameplate data.

### 3.9 PROCEDURES FOR HEAT-TRANSFER COILS

- A. Electric-Heating Coils: Measure the following data for each coil:
  - 1. Nameplate data.
  - 2. Airflow.
  - 3. Entering- and leaving-air temperature at full load.
  - 4. Voltage and amperage input of each phase at full load and at each incremental stage.
  - 5. Calculated kilowatt at full load.
  - 6. Fuse or circuit-breaker rating for overload protection.
- B. Refrigerant Coils: Measure the following data for each coil:
  - 1. Dry-bulb temperature of entering and leaving air.
  - 2. Wet-bulb temperature of entering and leaving air.
  - 3. Airflow.
  - 4. Air pressure drop.
  - 5. Refrigerant suction pressure and temperature.

### 3.10 PROCEDURES FOR TEMPERATURE MEASUREMENTS

- A. During TAB, report the need for adjustment in temperature regulation within the automatic temperature-control system.
- B. Measure indoor wet- and dry-bulb temperatures every other hour for a period of two successive eight-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.
- C. Measure outside-air, wet- and dry-bulb temperatures.

### 3.11 TEMPERATURE-CONTROL VERIFICATION

- A. Verify that controllers are calibrated and commissioned.
- B. Check transmitter and controller locations and note conditions that would adversely affect control functions.
- C. Record controller settings and note variances between set points and actual measurements.
- D. Check the operation of limiting controllers (i.e., high- and low-temperature controllers).
- E. Check free travel and proper operation of control devices such as damper and valve operators.
- F. Check the sequence of operation of control devices. Note air pressures and device positions and correlate with airflow and water flow measurements. Note the speed of response to input changes.
- G. Check the interaction of electrically operated switch transducers.
- H. Check the interaction of interlock and lockout systems.
- I. Check main control supply-air pressure and observe compressor and dryer operations.
- J. Record voltages of power supply and controller output. Determine whether the system operates on a grounded or nongrounded power supply.
- K. Note operation of electric actuators using spring return for proper fail-safe operations.

### 3.12 TOLERANCES

- A. Set HVAC system airflow and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus 5 to plus 10 percent.
  - 2. Air Outlets and Inlets: 0 to minus 10 percent.
  - 3. Heating-Water Flow Rate: 0 to minus 10 percent.
  - 4. Cooling-Water Flow Rate: 0 to minus 5 percent.

### 3.13 FINAL REPORT

- A. General: Typewritten, or computer printout in letter-quality font, on standard bond paper, in three-ring binder, tabulated and divided into sections by tested and balanced systems.
- B. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
  - 1. Include a list of instruments used for procedures, along with proof of calibration.
- C. Final Report Contents: In addition to certified field report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance, but do not include Shop Drawings and Product Data.
- D. General Report Data: In addition to form titles and entries, include the following data in the final report, as applicable:
  - 1. Title page.
  - 2. Name and address of TAB firm.
  - 3. Project name.
  - 4. Project location.
  - 5. Architect's name and address.
  - 6. Engineer's name and address.
  - 7. Contractor's name and address.
  - 8. Report date.
  - 9. Signature of TAB firm who certifies the report.
  - 10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 11. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 12. Nomenclature sheets for each item of equipment.
  - 13. Data for terminal units, including manufacturer, type size, and fittings.
  - 14. Notes to explain why certain final data in the body of reports varies from indicated values.
  - 15. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outside-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.

- f. Inlet vane settings for variable-air-volume systems.
  - g. Settings for supply-air, static-pressure controller.
  - h. Other system operating conditions that affect performance.
- E. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
  - 1. Quantities of outside, supply, return, and exhaust airflows.
  - 2. Water and steam flow rates.
  - 3. Duct, outlet, and inlet sizes.
  - 4. Pipe and valve sizes and locations.
  - 5. Terminal units.
  - 6. Balancing stations.
  - 7. Position of balancing devices.

### 3.14 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional testing, inspecting, and adjusting during near-peak summer and winter conditions.

**END OF SECTION 15950**

# **DIVISIONS 16-18**

## **ELECTRICAL**



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DATE:	February 13, 2023
CLIENT:	Great West Engineering
PROJECT:	Bonner County Solid Waste Colburn Facility Improvements

<u>SPECIFICATION</u> <u>SECTION</u>	<u>SECTION</u> <u>DESCRIPTION</u>
16012	ELECTRICAL GENERAL
16013	ELECTRICAL DEMOLITION
16112	ELECTRICITY METERING
16119	LOW-VOLTAGE CONDUCTORS AND CABLES
16123	CONTROL-VOLTAGE ELECTRICAL POWER CABLES
16126	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
16129	HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS
16133	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
16143	UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS
16144	SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING
16153	IDENTIFICATION FOR ELECTRICAL SYSTEMS
16231	PACKAGED GENERATOR
16416	PANELBOARDS
16426	WIRING DEVICES
16430	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
16453	VARIABLE-FREQUENCY MOTOR CONTROLLERS
16480	TRANSFER SWITCHES
16483	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
16519	LED INTERIOR LIGHTING
16539	LED EXTERIOR LIGHTING
16541	LIGHTING CONTROL DEVICES
16670	ELECTRICAL TESTING
16851	HEATING VENTILATION AND AIR CONDITIONING ELECTRICAL COORDINATION
18111	DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEMS

The technical specification sections listed above have been prepared under the direction of the Professional Engineer, licensed in the State of Idaho, whose seal and signature appear below:



## **SECTION 16012**

### **ELECTRICAL GENERAL**

#### **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.
- B. Reference Section 02221 for Trenching.
- C. Reference Division 9 for Finishes including paints and coatings.

##### **1.2 SUMMARY**

- A. Related Sections:
  - 1. Division 13, and Division 15 for electrical and mechanical coordination.

##### **1.3 DEFINITIONS**

- A. The words “plans” and “drawings” are used interchangeably in this specification and in all cases shall be interpreted to mean "drawings".
- B. The word “provide” shall be interpreted to mean furnish and install.
- C. “Owner” shall be Bonner County, Idaho.
- D. “Contractor” is the party who furnishes and installs all tools, materials, and equipment. This includes the Prime Contractor, the Electrical Contractor, Control System Integrator, and all other Contractors and Sub Contractors.
- E. “Control System Integrator” (CSI) also referred to as the System Integrator or Integrator is the Party that furnishes all control components and designs the detailed control wiring diagrams plus the layout and assembly of the custom control panels.
- F. “Control System” includes all equipment, instruments and wiring for control and monitoring of all operating pumps and equipment. This includes custom control panels, motor control center, packaged control panels, and control equipment furnished with other systems and mechanical equipment. All sensing, transmitting, indicating, control and recording of all functions as specified and shown are also included in the control system.

##### **1.4 SUBMITTAL REQUIREMENTS**

- A. Submittals shall comply with the requirements of specification Section 01300 in addition to the requirements in this Section and other Division 16 Sections.



- B. The Contractor shall prepare and submit to the Engineer a Schedule of Submittals prior to the approval of material submittals. The Schedule of Submittals shall comprise a comprehensive list of all submittals required to be submitted by the Contractor for the project and a rough outline of the days that those submittals will be received. The submittal schedule shall be organized by specification section and broken down into Action, Informational and Closeout submittals.
- C. Shop Drawings and Samples:
1. Where required by these Specifications, the Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with Section 01300 and other Division 16 Sections. Each submittal will be identified as Engineer may require.
    - a. Shop Drawings
  2. Shop drawings shall be submitted in electronic PDF format or physical copies on non-folded sheets no larger than 11"x17". PDF submittals shall be clear and legible. If submitting physical copies, submit number of copies specified in the respective specification section.
  3. 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 1.4.E.
    - a. Samples
  4. Submit number of Samples specified in the Specifications or as requested by the Engineer.
  5. 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 enabling Engineer to review the submittal for the limited purposes required by Paragraph 1.4.E.
  6. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineers review and approval of the pertinent submittal shall be at the sole expense and responsibility of Contractor.
- D. Submittal Procedures
1. Before submitting each Submittal, Shop Drawing or Sample, Contractor shall have determined and verified the following:
    - a. All field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto.
    - b. The suitability of all materials with respect to intended use, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work.
    - c. All information relative to Contractor's responsibilities for means, methods, techniques, sequences, procedures of construction, and safety precautions and programs incident thereto.
  - d. Contractor has reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents.

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 and approval of that submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Submittal, Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be indicated both as a written communication separate from the Shop Drawing or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.
4. Provide cut sheets for all products with a Bill of Materials showing quantity, manufacturer, catalog number, and the supplier name and phone number and relevant spec. paragraph number. Number each item in the bill of materials and relate the bill of materials to the submitted product index.
5. Identify on the cut sheets the exact model number, including any options, and the intended use of each item. Identification shall be by tag number of the equipment as shown on the drawings or a description of where it will be used. Submittals that are not clear as to the intended use of each item it contains will be rejected.
6. All Submittals and Shop Drawings shall be reviewed, signed and dated prior to Engineers review by:
  - a. General Contractor.
  - b. Electrical Contractor.
  - c. Control System Integrator.

E. Engineer's Review

1. The Engineer will provide timely review of Submittals, 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 (except where a particular means, method, technique sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval 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 1.4.D.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's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 1.4.D.1.

F. 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 Submittals and 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.

## 1.5 ACTION SUBMITTALS

- A. Schedule of Submittals organized by specification section and including the following:
  - 1. Action, Informational and Closeout submittal subcategories for each specification section.
  - 2. Unique submittal number.
  - 3. Name of submittal.
  - 4. Anticipated date of submission.
  - 5. Summary of submittal content.
- B. Project Schedule in Gantt chart format that outlines the project work tasks with duration, start and finish dates.

## 1.6 CLOSEOUT SUBMITTALS

- A. OPERATION AND MAINTENANCE MANUALS
  - 1. The Contractor shall prepare and assemble detailed operation and maintenance manuals in accordance with the project general requirements and other requirements in Section 01730. The manuals shall be bound in a 3-ring binder and tabbed with an index, in general the O&M manual format shall meet that of the submittal data in Division 16 sections. The manuals shall include, but not be limited to, the following:
    - a. Catalog data and complete parts list for all equipment and devices.
    - b. All cut sheets of equipment and components.
    - c. Preventative maintenance procedures
    - d. Trouble-shooting
    - e. Calibration
    - f. Testing
    - g. Replacement of components
    - h. Automatic mode operation
    - i. Manual mode operation
    - j. System schematics / shop drawings and record drawings.
    - k. As-built wiring diagrams of cabinet and enclosure contained assemblies
    - l. As-built wiring diagrams of overall system
    - m. Listing of recommended spare parts
    - n. Listing of recommended maintenance tools and equipment.
- B. Operations and Maintenance Training Outline:
  - 1. Submit Training Outlines once prior to conducting required training. Outlines shall be submitted at least two weeks in advance of conducting the required training.
  - 2. Submit Training Outlines signed by each person instructed after the completion of the required training.

## 1.7 GENERAL WORK REQUIREMENTS

- A. The Contractor shall provide all labor, material, tools, equipment and services required to complete the furnishing, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical equipment, devices and components as indicated and implied by the plans and these specifications.

- B. Complete the wiring to, connection to, adjustment and calibration of, testing of equipment having electric motors and/or built-in or furnished electrical components. Install electrical components that are furnished with mechanical equipment.
- C. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components, accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified function properly.
- D. The Contractor shall install and make all connections to the equipment furnished by the Owner.
- E. Provide the size, type and rating of motor control devices, equipment and wiring necessary to match the ratings of motors furnished with mechanical equipment.
- F. Provide adequate space for the electrical installation, including but not limited to, determination of access-ways and doorways, shipping sections, wall and floor space, and space occupied by mechanical equipment. Provide electrical equipment that fits in the areas shown on the drawings. All equipment shall be readily accessible for maintenance, shall have electrical clearances in accordance with NEC and shall be installed in locations that will provide adequate cooling.
- G. Check electrical equipment prior to installation so that defective equipment is not installed. Acceptance testing for electrical equipment shall be performed as discussed in Sections 16670 and 16928.
- H. Provide start-up, follow-up and training of the Owner's personnel for electrical systems. Make all corrective measures required during start-up. See specific requirements for training and start-up in other specification sections.
- I. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up of operation of the equipment, and to correct any problems, which occur during start-up.
- J. Provide circuit breakers, conduit, wire and installation for all items, which require 120 VAC power.
- K. The MCC's (motor control centers), transfer switches, PLC's, control panels, and instrumentation shall be supplied through the Control System Integrator.
- L. Contractor shall attend an On-Site pre-submittal meeting with the General Contractor, Electrical Contractor, Control Systems Integrator, Owner and Engineers prior to submittals.

## 1.8 PROJECT DESCRIPTION

- A. The project consists of upgrades at the Colburn waste transfer site, including the following:
  - 1. Coordinate with local electric Utility Company for new electric services.

2. New electrical, control and instrumentation, associated equipment and wiring systems.
  3. Contractor shall provide all conduit and conductors required to install equipment specified in Sections 11100, 11200, and 11300.
- B. It is the intent of these documents to describe the work required to complete this project in sufficient detail to secure comparable bids. All parts or work not specifically mentioned which are necessary in order to provide a complete installation shall be included in the bid and shall conform to all Local, State and Federal requirements.
- C. Provide electrical upgrades, additions and modifications as indicated on the drawings.

#### 1.9 PROJECT CONDITIONS

- A. Do not install electrical or control equipment and hardware that are wet, moisture damaged, or mold damaged.
- B. Environmental Limitations: Do not deliver or install electrical distribution, motor control, control panels, and other electrical apparatus until spaces are enclosed and weather-tight, wet work in spaces is complete and dry, work above ceilings is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- C. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements.
- D. Field Measurements: Verify actual dimensions of openings and available space by field measurements before fabrication.

#### 1.10 AREA CLASSIFICATIONS

- A. The following classification of areas shall be used as a reference in determining application of material covered in Division 16 Sections unless specifically shown otherwise on the drawings. Areas which fall under two or more of the following classifications shall conform to the minimum requirements of all area classifications listed for that area. Hazardous area classifications shall be defined by NFPA 70, NFPA 820 and the Area Classification plan sheets included in the Contract Documents.
- B. Hazardous Areas:
1. Hazardous Material Building.
- C. Outdoor Wet and/or Damp Areas:
1. All outdoor areas.
- D. Indoor Wet and/or Damp Areas:
1. Existing and new WTBs.
- E. Corrosive Areas:
1. None.

- F. General Purpose Areas:
  - 1. Other indoor buildings.

## 1.11 COORDINATION

- A. Equipment Coordination
  - 1. The Contractor is responsible to coordinate the equipment supplied from various manufacturers. This includes but is not limited to:
    - a. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.
    - b. Verifying the equipment supplied will fit within the space allocated.
    - c. Coordination of equipment and the electrical power and control requirements. Provided in all sections of the specifications and drawings.
    - d. Providing power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.
    - e. Providing all necessary control wiring and components for any special requirements from an equipment manufacturer.
  - 2. The Contractor shall verify as a minimum:
    - a. Correct voltage, phase and frequency
    - b. Size and space requirements
    - c. Mounting requirements
    - d. Correct motor starter type
    - e. Proper coordination with the controls and control system Integrator.
  - 3. Any discrepancies between the electrical and other equipment shall be brought to the immediate attention of the Engineer.
  - 4. The Contractor shall assure that no instrumentation or control interferences are created by the variable frequency controllers (VFC's) or load wiring. The Contractor shall coordinate with the VFC manufacturer to provide necessary separation of conductors or shielding and/or filtering equipment as required by the VFC manufacturer. If interferences do occur, the Contractor shall be responsible to take corrective action at no additional cost to the Owner.

## 1.12 ELECTRICAL WORK SEQUENCE

- A. The Contractor shall submit a detailed plan for the Work, portions of which are listed herein, for general review and consideration by the Owner and Engineer. In all cases, operation of existing plant equipment and processes must be maintained to maintain compliance with the Owner's NPDES Permit.
- B. Some work elements may be done simultaneously. Not all construction activities are noted. Coordinate construction schedule to incorporate the listed Major Work Elements items as a minimum.
- C. Planned Outages:
  - 1. Contractor shall notify the Owner and Engineer in writing at least two weeks in advance of any requested planned outage, unless otherwise noted.
  - 2. The treatment plant manager, or designated representative, shall have the right to cancel or terminate an outage at no cost to the Owner when in his opinion the potential for a safety hazard or violation of the discharge permit exists. However,

this does not relieve the Contractor of the responsibility to maintain a safe working environment and to maintain treatment plant operations.

3. If requested by the Owner or Engineer, the Contractor shall send a representative to meet with plant and Engineer's staff to plan activities during the requested outage.
4. Outages shall not be permitted on Fridays, weekends, or Holidays.
5. Shutdowns shall not occur on consecutive days unless previously approved by the Engineer and accepted by the Owner.

- D. Contractor's schedule shall include critical work elements generally noted herein and a sequence to:
1. Ensure the availability of adequate electrical power.
  2. Always ensure the availability of water distribution system during the completion of this contract.

#### 1.13 FINAL ACCEPTANCE

- A. Prior to final acceptance the Engineer will perform one or more site observation trips to develop a "punch list" of items deemed incomplete. The Electrical Contractor and Control System Integrator shall be present while these inspections are taking place and shall be available for opening cabinets and operating and adjusting the system as is necessary for the Engineer to verify all equipment is installed and operates to the requirements of the contract documents. The contractor shall anticipate a minimum of 16 hours to complete the final acceptance testing.
- B. Prior to the Contractor calling for this observation, the Contractor shall have completed all items of work, including wire markers, nameplates, final tests and final test reports. All equipment shall be checked for proper operation and all signals verified for correct calibration and wiring.
- C. Final acceptance will not be given until:
1. All work is complete.
  2. All punch-lists are checked off and returned to the Engineer.
  3. All test reports are received.
  4. All O&M manuals are received.
  5. All spare parts are received.
  6. All instrument test forms are received.
  7. All project record drawings are received.
- D. Punch Lists
1. Each punch list item shall be completed by the Contractor and checked off the punch list. When all items on the list are completed or commented on, the list shall be signed by the Contractor and returned to the Engineer for verification.

#### 1.14 PROJECT RECORD DRAWINGS

- A. A set of drawings shall be maintained at the job site (by the Electrical Contractor) showing any deviations in the electrical systems from the original design.

- B. This set of drawings shall be readily available for inspection by the Engineer at all times. The Engineer will check the Red-Lined As-Built drawings after each project meeting.
- C. Another complete set of drawings shall be marked up in the office showing the changes made on the field set of drawings. All changes shall be clearly marked in red on the drawings. Drawings shall be submitted to the Engineer at the completion of the project.
- D. A set of electrical drawings marked in red to indicate the routing of conduit runs, shall be submitted to the Engineer for review at the completion of conduit rough-in and prior to cover or pouring of concrete.

#### 1.15 GUARANTEE

- A. The Contactor shall guarantee his work and all components thereof, excluding incandescent and fluorescent lamps for a period of 1 year from date of acceptance of installation. The Contractor shall remedy any defects in workmanship and repair or replace any faulty equipment that shall appear within the guarantee period without additional cost to the Owner.

#### 1.16 CLEANUP

- A. The premises must be kept free of accumulated materials, rubbish and debris at all times. Surplus material, tools and equipment must not be stored at the job site. At the completion of the job, all equipment and fixtures shall be left clean and in proper condition for their intended use.
- B. All motor control centers (MCC's), Panelboards, and control panels shall be cleaned inside and out at the completion of the project.

#### 1.17 TESTS

- A. Testing for installed feeder cables and motors is required as specified in Sections 16670, 16119, and 16155. Instrumentation devices and wiring shall be tested as specified in Sections 16670, 16123 and 16928. Test reports shall be submitted to the Engineer prior to final acceptance. All tests shall be performed in accordance with the applicable sections of NETA.

#### 1.18 MAINTAINED OPERATION REQUIREMENTS

- A. This is an existing and operating facility. The existing systems must remain operational during construction.

#### 1.19 OPERATION AND MAINTENANCE TRAINING (OWNER INSTRUCTION)

- A. General:
  - 1. The Contractor and appropriate factory-trained representatives shall instruct the Owner's representative in the proper operation and maintenance of all electrical and control systems, equipment, and shall explain all warranties.
- B. Training Agenda Outline:



1. Prior to instruction of Owner Personnel, the Contractor shall prepare a typed outline, listing the subjects that will be included in this instruction, and shall submit the outline for review by the Engineer at least 2 weeks prior to the time of the training.
- C. Training Requirements:
1. Training shall be provided per the specific requirements in other sections of these specifications. In addition to training required in other sections of the specifications, the Contractor shall conduct specifically organized training sessions in the overall operation and maintenance of the electrical and control system for personnel employed by the Owner. The training sessions shall be conducted to educate and train the personnel in operations and maintenance of all components of the electrical system outside the training requirements in the other Sections.
  2. Training shall include, but not be limited to, the following:
    - a. Preventative maintenance procedures
    - b. Troubleshooting
    - c. Calibration
    - d. Testing
    - e. Replacement of components
    - f. Equipment operation
  3. At a minimum, 2 training session, each at least 6 hours in duration, shall be conducted at the facility after start-up of the electrical and control systems. The Contractor shall prepare and assemble specific instruction materials for each training session and shall supply such materials to the Owner at least 2 weeks prior to the time of the training.
- D. Certification:
1. At the conclusion of the instruction period, the Contractor shall obtain the signature of each person being instructed on each copy of the approved training outline to signify that the personnel has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.
- E. Other Requirements:
1. Refer to other Division 16 Sections for additional Operator Training requirements for specific pieces of equipment or specific systems.
  2. The Contractor shall coordinate the Operator Training requirements listed above with the Owner Instruction requirements of Division 1.

## 1.20 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment to the job site at the appropriate time for installation. Equipment items shall be crated or affixed to pallets with protective wrappings. Exercise care to prevent damage from handling. Store mechanical and electrical components and conductors off the ground in weathertight enclosures. Keep equipment and all electrical components dry at all times.
- B. Conductors shall be protected from damage at all times.
1. Conductors shall not be in contact with Earth.
  2. Conductors shall be protected from foot traffic.
  3. Any conductor deemed damaged by the engineer shall be replaced.

- C. Reference Division 1.

## **PART 2 - PRODUCTS**

### **2.1 ELECTRICAL LOCKOUT DEVICES**

- A. Contractor shall provide two Lockout Stations and two Breaker lockout Center. Install lockout equipment in the Headworks electrical room and UV Building per direction of engineer.
- B. Lockout Stations shall include a heavy-duty acrylic board with polycarbonate lock retention blocks.
  - 1. Included accessories shall include (4) Padlocks, (10) lockout tags with ties, (4) 1-1/2" multiple lockout device. Prinzing LC203G or approved equal.
- C. Breaker Lockout Centers shall include (1) Padlock, (1) lockout tag with ties, (1) single pole breaker lockout, (1) multi pole breaker lockout. Prinzing 3075 or approved equal.

**END OF SECTION**

## **SECTION 16013**

### **ELECTRICAL DEMOLITION**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION OF WORK:**

- A. This work shall consist of the removal and disposal, wholly or in part, of all electrical equipment, conduit and wire as stated or shown on the drawings or specifications to be removed. This also includes removal of electrical equipment associated with structural and mechanical equipment shown to be removed on the drawings or stated in the specifications.

##### **1.2 DISRUPTION OF OPERATIONS:**

- A. All demolition work shall be conducted so that disruption of the facility is minimal. Shutdown of equipment must be approved by and performed by the Owner.

##### **1.3 DISPOSAL OF PRODUCTS OF DEMOLITION:**

- A. The Contractor shall dispose of all materials associated with demolition and removal, at a site of his choosing. The Contractor shall be responsible for obtaining any and all necessary permits and shall comply with applicable codes, laws, and standards.

#### **PART 2 - PRODUCTS**

- A. Not Used

#### **PART 3 - EXECUTION**

##### **3.1 GENERAL DEMOLITION:**

- A. The Contractor shall conduct all demolition operations to avoid damage to adjacent property and structures. All electrical equipment associated with structural or mechanical equipment shown to be removed on the drawings shall be removed as part of the demolition of the mechanical or structural equipment.

##### **3.2 WIRE DEMOLITION:**

- A. All wire associated with equipment to be removed shall be disconnected and removed from the equipment back to the furthest point of connection which does not affect any other equipment operation.

##### **3.3 CONDUIT DEMOLITION:**

- A. All conduit associated with equipment to be removed shall be disconnected and removed from the equipment back to the furthest J-box or panel which will not affect any other equipment. Conduit poured into slabs or wall shown to be abandoned shall be cut off at

the wall or floor surface and plugged with concrete. Conduit (shown with wire removed only) poured into slabs or walls shall be provided with a pull cord and capped.

- B. Conduit removal shall include removal of all associated supports, boxes, etc. associated with the conduit to be removed which does not affect the operation of any other equipment.

#### 3.4 MOTOR CONTROL CENTER REMOVAL:

- A. Motor control centers designated for demolition/modification shall be removed or moved and reconnected for temporarily operation of equipment where necessary.
- B. Provide temporary power service conduit, wire, etc. as necessary for equipment which must remain in operation during motor control center relocation.

#### 3.5 PANEL DEMOLITION:

- A. Panels designated for demolition shall be removed or moved and reconnected for temporarily operation of equipment where necessary.

#### 3.6 MOTOR DEMOLITION:

- A. Motors designated for demolition shall be removed or moved and connected for temporarily operation of equipment where necessary. Provide temporary starters and control equipment if necessary for continued operation during construction.

#### 3.7 CONDUIT RELOCATION:

- A. Existing conduit which interferes with new equipment shall be rerouted around the new equipment or to the location as shown on the drawings. Existing wiring may be reused if the length does not require splices, otherwise provide new wire.

#### 3.8 LIGHTING RELOCATION:

- A. Existing lighting which interferes with new equipment shall be relocated and rewired to the nearest location possible which does not interfere with the new equipment, or to the location as shown on the drawings.

#### 3.9 EQUIPMENT TO BE RETAINED BY OWNER:

- A. Equipment designated to be retained by the Owner shall be transported to and unloaded at the Owner's designated storage site or prepared for shipment and loaded on the Owner's truck for storage off the immediate property.
- B. Owner has first right of salvage on all material.
- C. Deliver all demolished conductors to Owner.

### **END OF SECTION**

## SECTION 16112

### ELECTRICITY METERING

#### 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 work to accommodate utility company revenue meters, and Owner's electricity meters used to manage the electrical power system.
- B. Section includes utility upgrade requirements and division of responsibility.

##### 1.3 DEFINITIONS

- A. CT: Current Transformer
- B. KY or KYZ Pulse: Term used by the metering industry to describe a method of measuring consumption of electricity (kWh) that is based on a relay opening and closing in response to the rotation of the disk in the meter. Electronic meters generate pulses electronically.

##### 1.4 ACTION SUBMITTALS

- A. Product Data:
  - 1. For each type of product indicated.
  - 2. For metering infrastructure components.
  - 3. For metering software.
- B. Shop Drawings: For electricity-metering equipment.
  - 1. Include elevation views of front panels of control and indicating devices and control stations.
  - 2. Include diagrams for power, signal, and control wiring.
  - 3. Wire Termination Diagrams and Schedules: Include diagrams for power, signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
  - 4. Include series-combination rating data for modular meter centers with main disconnect device.
  - 5. Retain "Block Diagram" Subparagraph below if this Section includes PC-based local area data bus or link to BAS.

6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices used. Describe characteristics of network and other data communication lines.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Submit evidence that meters are compatible with connected monitoring and control devices and systems specified in Section 16679 "Electrical Power Monitoring and Control."
  1. Show interconnecting signal and control wiring, and interface devices to show compatibility of meters.
  2. For reporting and billing interfaces and adapters, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the protocol.
- B. Qualification Data: For testing agency.
- C. Field quality-control reports.
- D. Sample Warranty: For special warranty.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: In addition to items specified in Section 01730 "Operation and Maintenance Data," include the following:
  1. Application and operating software documentation.
  2. Software licenses.
  3. Software service agreement.
  4. Device address list.
  5. Hard copies of manufacturer's operating specifications, user's guides for software and hardware, and PDF files on a USB storage device of hard-copy Submittal.
  6. Meter data sheet for each meter, listing nameplate data and serial number, accuracy certification, and test results.
  7. Meter installation and billing software startup report.

## 1.7 SCHEDULING WORK WITH THE UTILITY COMPANY:

- A. The Contractor shall be fully and completely responsible for all scheduling and coordination with the utility company. The Contractor shall coordinate and schedule power outages, power service for operation and construction, and power service as may be required by the facility prior to Certificate of Occupancy.
- B. The Contractor shall make all necessary applications for service with the utility and shall notify the Owner in writing of any obligations that the Owner must fulfill for the service to be started, installed or modified.

## 1.8 CONTRACTOR/UTILITY INTERFACE RESPONSIBILITIES:

- A. The electrical utility providing service to these facilities is Northern Lights Electric Coop. Contact Dan Scholz, 509-946-5958, [Dan.Scholz@nli.coop](mailto:Dan.Scholz@nli.coop)
- B. The division of responsibilities stated below has been determined by coordination with the utilities. The Contractor shall comply with all utility company standards and requirements.
- C. All utility company charges for and related to the final permanent service to the facility will be paid by the Owner directly to the utility company and shall not be included in the Contractor's bid price.
- D. The Contractor shall:
  - 1. Provide trenching, backfill and borrow material for the secondary service.
  - 2. Provide underground secondary conduit from the utility transformers to the CT enclosure or utility meter.
  - 3. Provide the meter enclosure, and conduit and wire between the CT enclosures, meter bases and service disconnects.
- E. The Utility shall:
  - 1. Provide primary service conductors to new transformers.
  - 2. Provide new service transformers and terminate primary and secondary conductors.
  - 3. Provide and install meters in Contractor supplied enclosures.
  - 4. Provide conductors from the utility transformers to the CT enclosures.
  - 5. Relocate existing power pole as indicated on the drawings.

## 1.9 TEMPORARY CONSTRUCTION POWER

- A. Contractor shall provide temporary power.
  - 1. Colburn: temporary power will be required to keep the existing WTB and Attendant Shack in operation during construction.
  - 2. Idaho Hill: temporary power will be required to keep the existing Attendant Shack and Front Loader Shed Building in operation during construction.
  - 3. Temporary power may also be required at Dickensheet and Dufort during construction.

## 1.10 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with all serving utility company standards and requirements.
- C. Service equipment shall be listed and labeled by UL as "suitable for use as service equipment."

## 1.11 FIELD CONDITIONS

- A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Owner shall be notified and issued written permission no fewer than two days in advance of proposed interruption of electrical service.
  - 2. Do not proceed with interruption of electrical service without Owner's written permission.
  - 3. Notify Owner in writing and submit a detailed outage plan for approval prior to beginning work. Reference Section 01014 and 16015 for additional requirements for continuity of operations.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 916.

### 2.2 UTILITY METERING INFRASTRUCTURE

- A. Install metering accessories furnished by the utility company, complying with its requirements.
- B. Utility-Furnished Meters: Connect data transmission facility of metering equipment installed by the Utility.
- C. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
- D. Meter Sockets:
  - 1. Comply with requirements of electrical-power utility company.
  - 2. Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.



### 3.2 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 16153 "Identification for Electrical Systems."

### 3.3 UTILITY REQUIREMENT VERIFICATION

- A. The Contractor shall coordinate and submit all equipment, materials, etc. related to the utility work to the serving utility to verify conformance to the Utility's requirements for service. The Contractor shall also submit any plans for the installation of the primary and secondary service for approval by the Utility prior to excavation. Any discrepancy between the Utility requirements and the Contract documents shall be brought to the immediate attention of the Engineer.

### 3.4 TESTING

- A. Comply with requirements of Section 16670.

**END OF SECTION**

## **SECTION 16119**

### **LOW-VOLTAGE CONDUCTORS AND CABLES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Copper building wire rated 600 V or less.
  - 2. Metal-clad cable, Type MC, rated 600 V or less.
  - 3. Armored cable, Type AC, rated 600 V or less.
  - 4. Mineral-insulated cable, Type MI, rated 600 V or less.
  - 5. Tray cable, Type TC, rated 600 V or less.
  - 6. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
  - 1. Section 16123 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

##### **1.3 DEFINITIONS**

- A. RoHS: Restriction of Hazardous Substances.
- B. VFC: Variable-frequency controller.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. NBR: Acrylonitrile-butadiene rubber.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Product Schedule: Indicate type, use, location, and termination locations.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
- C. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 COPPER BUILDING WIRE

- A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Alpha Wire Company.
  - 2. American Bare Conductor.
  - 3. Belden Inc.
  - 4. Cerro Wire LLC.
  - 5. Encore Wire Corporation.
  - 6. General Cable Technologies Corporation.
  - 7. Okonite Company (The).
  - 8. Service Wire Co.
  - 9. Southwire Company.
  - 10. WESCO.
- C. Standards:
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  - 2. RoHS compliant.
  - 3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 and ASTM B496 for stranded conductors.
- E. Conductor Insulation:
  - 1. Type THHN and Type THWN-2: Comply with UL 83 and NEMA WC 70.
  - 2. Type XHHW and Type XHHW-2: Comply with UL 44 and NEMA WC 70.
- F. Shielded Power Cable:
  - 1. Type TC-ER: Cable designed for use with VFCs, with oversized crosslinked polyethylene insulation, spiral-wrapped foil plus 85 percent coverage braided shields and insulated full-size ground wire, dual spirally wrapped copper tape

shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

2. For motors 150HP and less driven by VFD's, provide shielded power cables with integral ground for the motor leads between variable frequency drives and the motors. Cables shall be 600V, UL 1277, Type TC-ER per NEC Article 336, rated 90 Degrees C Wet/Dry. Shielding shall be tinned copper braid and tinned copper drain wire. Belden 29500 series or equal.

## 2.2 METAL-CLAD CABLE, TYPE MC

- A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Okonite Company (The).
  2. General Cable Technologies Corp.
  3. Belden, Inc.
  4. Southwire Company.
- C. Standards:
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Comply with UL 1569.
  3. Hazardous Location: Metal-clad cable used in hazardous locations shall be listed and labeled as type MC-HL for use in Class I, II and III, Division 1 and 2 areas.
    - a. MC-HL cable shall be installed using appropriate fittings listed and labeled for use with type MC-HL cable and approved for the classified area in which they are installed.
  4. RoHS compliant.
  5. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
  1. Single circuit and multi-circuit with color-coded conductors.
  2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Bare.
- G. Conductor Insulation:
  1. Type TFN/THHN/THWN-2: Comply with UL 83.
  2. Type XHHW-2: Comply with UL 44.
- H. Armor: Aluminum, interlocked.
- I. Fittings: Stainless steel.

J. Jacket: PVC applied over armor.

## 2.3 ARMORED CABLE, TYPE AC

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in an overall metallic sheath.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Atkore International (AFC Cable Systems).
  2. Belden Inc.
  3. General Cable Technologies Corporation.
  4. Okonite Company (The).
  5. Service Wire Co.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Not all Type AC cable will comply with RoHS requirements, such as some types with galvanized-steel armor. Consult manufacturer.
  3. RoHS compliant.
  4. Comply with UL 4.
  5. See the Evaluations for discussion of UL's "Wire and Cable Marking and Application Guide."
  6. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Circuits:
1. Single circuit and multi-circuit with color-coded conductors.
  2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.
- E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- F. Ground Conductor: Insulated.
- G. Conductor Insulation: Type THHN/THWN-2. Comply with UL 83.
- H. Armor: Aluminum, interlocked.

## 2.4 MINERAL-INSULATED CABLE, TYPE MI

- A. Description: Solid copper conductors encased in compressed metal oxide with an outer metallic sheath, rated 600 V or less.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. KME America, Inc.

2. nVent.
  3. Watlow Electric Manufacturing Company.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. UL 2196 for fire resistance.
  3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper.
- E. Insulation: Compressed magnesium oxide.
- F. Sheath: Copper. Stainless steel and Alloy 600/825 also available (alloys 600 and 825 are highly corrosion resistant alloys consisting of primarily nickel, iron and chromium)

## 2.5 TRAY CABLE, TYPE TC

- A. Description: A factory assembly of insulated current-carrying conductors with or without an equipment grounding conductor in a nonmetallic jacket.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Belden Inc.
  2. General Cable Technologies Corporation.
  3. Okonite Company (The).
  4. Southwire Company.
- C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
  2. Not all Type TC cable may comply with RoHS requirements. Consult manufacturer.
  3. RoHS compliant.
  4. Comply with UL 1277.
  5. Comply with ICEA S-73-532/NEMA WC 57 for Type TC cables used for control, thermocouple extension, and instrumentation.
  6. Comply with ICEA S-95-658/NEMA WC 70 for Type TC cables used for power distribution.
  7. See the Evaluations for discussion of UL's "Wire and Cable Marking and Application Guide."
  8. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."
- D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.
- E. Ground Conductor:

1. Unshielded Power Cable: Bare.
  2. Shielded Power Cable: Insulated.
- F. Conductor Insulation: Type XHHW-2. Comply with UL 44.
- G. Shield:
1. Unshielded Power Cable: None
  2. Shielded Power Cable: Overall Aluminum/Polyester foil 100% coverage with 85% coverage tinned copper braid outer shield and tinned copper drain wire.

## 2.6 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. 3M Electrical Products.
  2. ABB (Electrification Products Division).
  3. Emerson Electric Co. (Automation Solutions - Appleton - O-Z/Gedney).
  4. ILSCO.
  5. NSi Industries LLC.
  6. Raychem.
- C. Mechanical Multi-Tap Connectors: Insulated mechanical tap connectors with removeable screw and port caps. ILSCO Nimbus PBTS series or approved equal.
- D. Underground Splices:
1. Mechanical Multi-Tap Splice: Watertight, insulated mechanical splices with number and size of ports as required for the application. Material shall be high-strength aluminum alloy with resealable tethered wire and screw ports. ILSCO Safetysub PDSS series or approved equal.
  2. Heat Shrink Splice Sleeves: Watertight, heat shrink splice kits with dual rated tin-plated aluminum mechanical splice for copper and aluminum conductors with heavy wall heat shrink sleeve.
- E. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- F. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper.
  2. Type: Two hole with long barrels.
  3. Termination: Compression.
- G. Motor Terminal Splice Insulation
1. Provide motor terminal splice insulation in the motor connection box that will withstand constant vibration and abrasion without degrading the insulation of the

- splice. A product shall be used that is specifically designed for the purpose of motor terminations.
2. For motor splices in general purpose areas use a bolted splice with a boot-type motor stub splice insulator with integral TY RAP cable ties. Thomas & Betts MSC series or equal. For splices using wire larger than 8 AWG, it is also acceptable to use a heat shrinkable motor stub splice connection kit, Raychem, MCK-V or equal.
  3. For motors in outdoor, damp or corrosive environments, use a waterproof motor stub insulator, Thomas & Betts multi-splice insulator MSLT series or equal. For splices using wire larger than 8 AWG, it is also acceptable to use a heat shrinkable motor stub splice connection kit, Raychem, MCK-V series or equal.

## **PART 3 - EXECUTION**

### **3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. Control Conductors: Copper Stranded.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

### **3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Service Entrance: Type XHHW-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- F. Feeders in Cable Tray: Type THHN/THWN-2, single conductors in raceway.
- G. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.



- I. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- J. Branch Circuits in Cable Tray: Type THHN/THWN-2, single conductors in raceway.
- K. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- L. Class 1 Control Circuits: Type THHN/THWN-2 in raceway.
- M. Class 2 Control Circuits: Type THHN/THWN-2 in raceway.
- N. VFC Output Circuits: Type XHHW-2 in metal conduit or Type TC-ER cable with braided shield as indicated on the Conduit and Wire Schedule.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 16133 "Raceways and Boxes for Electrical Systems" and Section 16143 "Underground Ducts and Raceways for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 16129 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 16136 "Cable Trays for Electrical Systems" prior to installing conductors and cables.
- H. Conductor Spacing:
  - 1. Unless specifically shown otherwise on the drawings, in all areas maintain a minimum 2-inch separation between all conductors of different voltages. For parallel runs over 6 feet, maintain the following minimum separation between conductors:
    - a. Signal (12/24) VDC and 120 VAC – 6 inches
    - b. Signal (12/24) VDC and 480 VAC – 12 inches
    - c. 120 VAC control wire and 480 VAC – 2 inches
- I. Wire Bending Radius:

1. The radius of bends in all wire (conductors and cables) shall not be less than five (5) times the outside diameter of the wire. Any wire installed with bends less than five times the diameter which the engineer deems has caused that insulation to be damaged shall be removed and new wire shall be installed.

### 3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than un-spliced conductors.
  1. Retain subparagraph below if aluminum conductors are specified.
  2. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors. Splices for aluminum conductors shall be compression type.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

### 3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 16153 "Identification for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

## **END OF SECTION**

## **SECTION 16123**

### **CONTROL-VOLTAGE ELECTRICAL POWER CABLES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Backboards.
  - 2. Category 5e balanced twisted pair cable.
  - 3. Category 6 balanced twisted pair cable.
  - 4. Category 6a balanced twisted pair cable.
  - 5. Balanced twisted pair cabling hardware.
  - 6. RS-485 cabling.
  - 7. Low-voltage control cabling.
  - 8. Control-circuit conductors.
  - 9. Identification products.

##### **1.3 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- C. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

##### **1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency, RCDD, layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

## PART 2 - PRODUCTS

### 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
  - 1. Flame Travel Distance: 60 inches or less.
  - 2. Peak Optical Smoke Density: 0.5 or less.
  - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.
- E. RoHS compliant.

### 2.2 BACKBOARDS

- A. Description: Plywood. Comply with requirements for plywood backing panels in Section 06100 "Rough Carpentry."

### 2.3 CATEGORY 5E BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 5e cable at frequencies up to 100 MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Belden Inc.
  - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 3. CommScope, Inc.
  - 4. Turck.
- C. Standard: Comply with ICEA S-90-661, NEMA WC 63.1, and TIA-568-C.2 for Category 5e cables.

- D. Conductors: 100-ohm, 24 AWG solid copper.
- E. Shielding/Screening: Unshielded twisted pairs (UTP).
- F. Cable Rating: Cable ratings shall be as required per application. Cables installed in Risers and Plenums shall be listed and labeled for such use as required per NFPA 70.
- G. Jacket: Blue, yellow, grey or white thermoplastic, per Owner's color convention.

#### 2.4 CATEGORY 6 BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6 cable at frequencies up to 250MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Belden CDT Networking Division/NORDX.
  - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 3. CommScope, Inc.
  - 4. Turck.
- C. Standard: Comply with NEMA WC 66/ICEA S-116-732 and TIA-568-C.2 for Category 6 cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.
- ~~E.~~ Shielding/Screening: Shielded twisted pairs (FTP)
- F. Cable Rating: Cable ratings shall be as required per application. Cables installed in Risers and Plenums shall be listed and labeled for such use as required per NFPA 70.
- G. Jacket: Blue, yellow, grey or white thermoplastic, per Owner's color convention.

#### 2.5 CATEGORY 6A BALANCED TWISTED PAIR CABLE

- A. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of Category 6a cable at frequencies up to 500MHz.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Belden CDT Networking Division/NORDX.
  - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 3. CommScope, Inc.
  - 4. Turck.
- C. Standard: Comply with TIA-568-C.2 for Category 6a cables.
- D. Conductors: 100-ohm, 23 AWG solid copper.

- E. Shielding/Screening: Shielded twisted pairs (FTP)
- F. Cable Rating: Cable ratings shall be as required per application. Cables installed in Risers and Plenums shall be listed and labeled for such use as required per NFPA 70.
- G. Jacket: Blue, yellow, grey or white thermoplastic, per Owner's color convention.

## 2.6 BALANCED TWISTED PAIR CABLE HARDWARE

- A. Description: Hardware designed to connect, splice, and terminate balanced twisted pair copper communications cable.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Belden Inc.
  - 2. Berk-Tek Leviton; a Nexans/Leviton alliance.
  - 3. CommScope, Inc.
- C. General Requirements for Balanced Twisted Pair Cable Hardware:
  - 1. Comply with the performance requirements of Category 5e, Category 6 or Category 6a as required.
  - 2. Comply with TIA-568-C.2, IDC type, with modules designed for punch-down caps or tools.
  - 3. Cables shall be terminated with connecting hardware of same category or higher.
- D. Source Limitations: Obtain balanced twisted pair cable hardware from same manufacturer as balanced twisted pair cable, from single source.
- E. Connecting Blocks: 66-style or 110-style IDC as indicated on the drawings and approved for use with the category of cable used. Provide blocks for the number of cables terminated on the block, plus 25 percent spare, integral with connector bodies, including plugs and jacks where indicated.
- F. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
  - 1. Number of Terminals per Field: One for each conductor in assigned cables.
- G. Patch Panel: Modular panels housing numbered jack units with IDC-type connectors at each jack location for permanent termination of pair groups of installed cables.
  - 1. Features:
    - a. Universal T568A and T568B wiring labels.
    - b. Labeling areas adjacent to conductors.
    - c. Replaceable connectors.
    - d. 24 or 48 ports.
  - 2. Construction: 16-gauge steel and mountable on 19-inch equipment racks.
  - 3. Number of Jacks per Field: One for each four-pair conductor group of indicated cables, plus spares and blank positions adequate to suit specified expansion criteria.

- H. Patch Cords: Factory-made, four-pair cables in 48-inch lengths; terminated with an eight-position modular plug at each end.
  - 1. Patch Cords for Category 6 and 6a: Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure performance. Patch cords shall have latch guards to protect against snagging.
  - 2. Patch Cords for Category 5e: Patch cords shall have color-coded boots for circuit identification.
- I. Plugs and Plug Assemblies:
  - 1. Male; eight position; color-coded modular telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
  - 2. Comply with IEC 60603-7-1, IEC 60603-7-2, IEC 60603-7-3, IEC 60603-7-4, and IEC 60603-7.5.
  - 3. Marked to indicate transmission performance.
- J. Jacks and Jack Assemblies:
  - 1. Female; eight position; modular; fixed telecommunications connector designed for termination of a single four-pair 100-ohm unshielded or shielded balanced twisted pair cable.
  - 2. Designed to snap-in to a patch panel or faceplate.
  - 3. Standards:
    - a. Category 5e, unshielded balanced twisted pair cable shall comply with IEC 60603-7-2.
    - b. Category 5e, shielded balanced twisted pair cable shall comply with IEC 60603-7-3.
    - c. Category 6, shielded balanced twisted pair cable shall comply with IEC 60603-7.5.
    - d. Category 6a, shielded balanced twisted pair cable shall comply with IEC 60603-7.51.
  - 4. Marked to indicate transmission performance.
- K. Faceplate:
  - 1. Two port, vertical single-gang faceplates designed to mount to single-gang wall boxes, unless otherwise indicated.
  - 2. Metal Faceplate: Stainless steel, complying with requirements in Section 16426 "Wiring Devices."
  - 3. For use with snap-in jacks accommodating any combination of balanced twisted pair, optical fiber, and coaxial work area cords.
    - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
- L. Legend:
  - 1. Machine printed, in the field, using adhesive-tape label.
  - 2. Snap-in, clear-label covers and machine-printed paper inserts.

## 2.7 RS-232 CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Allied Wire & Cable Inc.

2. Belden Inc.
  3. General Cable Technologies Corporation.
- B. PVC-Jacketed, TIA 232-F:
1. Nine, No. 24 AWG, stranded (7x32) tinned copper conductors.
  2. Semi-Rigid Polyvinyl Chloride Insulation.
  3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
  4. PVC jacket.
  5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  6. NFPA 70 Type: Type CM.
  7. Flame Resistance: Comply with UL 1581.
  8. Belden 9539 or approved equal.
- C. Plenum-Type, TIA 232-F:
1. Ten, No. 24 AWG, stranded (7x32) tinned copper conductors.
  2. Fluorinated Ethylene Propylene insulation.
  3. Aluminum foil-polyester tape shield with 100 percent shield coverage.
  4. Low Smoke PVC jacket.
  5. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  6. NFPA 70 Type: CMP
  7. Flame Resistance: Comply with NFPA 262.
  8. Belden 82505 or approved equal.

## 2.8 RS-485 CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Wire & Cable Inc.
  2. Belden Inc.
  3. General Cable Technologies Corporation.
- B. Standard Cable: NFPA 70, Type CMG.
1. Paired, two twisted pairs, No. 28 AWG, stranded (7x36) tinned-copper conductors.
  2. Polyethylene Insulation.
  3. Aluminum-foil polyester tape shield with 100 percent coverage and tinned copper braid with 90% coverage.
  4. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
  5. PVC jacket.
  6. Flame Resistance: Comply with UL 1685.
  7. Belden 9842 or approved equal.
- C. Plenum-Rated Cable: NFPA 70, Type CMP.
1. Paired, two twisted pairs, No. 24 AWG, stranded (7x32) tinned-copper conductors.
  2. Foam fluorinated ethylene propylene insulation.



3. Aluminum foil-polyester tape with 100 percent shield coverage and tinned copper braid shield with 90% coverage.
4. Conductors are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
5. Low Smoke PVC Jacket.
6. Belden 82842 or approved equal.
7. Flame Resistance: Comply with NFPA 262.

## 2.9 HIGH-TEMPERATURE RTD WIRE

- A. RTD Wire:
  1. Three-conductor, No. 16 AWG, stranded (16x29) tinned-copper conductors.
  2. Fluorinated ethylene propylene insulation.
  3. Aluminum foil-polyester tape with 100 percent shield coverage and tinned copper braid with 85% coverage.
  4. Operating Temp Range: -70 degrees C to 200 degrees C.
  5. Belden 83703 or approved equal.

## 2.10 LOW-VOLTAGE CONTROL CABLE

- A. Paired Cable: NFPA 70, Type TC.
  1. Single-Pair Cable: Twisted, No. 16 AWG, stranded (19x29) tinned-copper conductors. Belden 9342 or approved equal.
    - a. Aluminum foil-polyester tape with 100 percent shield coverage with No. 16 AWG, stranded tinned copper drain wire.
  2. Multi-Pair Cable: Twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors with number of pairs as indicated on the drawings. Belden 9770 series or approved equal.
    - a. Aluminum foil-polyester tape with 100 percent shield coverage with No. 20 AWG, stranded tinned copper drain wire.
  3. PVC/Nylon insulation, color coded.
  4. PVC jacket.
  5. Flame Resistance: Comply with UL 1685.
- B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
  1. Single-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
  2. PVC insulation.
  3. Unshielded.
  4. PVC jacket.
  5. Flame Resistance: Comply with NFPA 262.
  6. Belden 88760 or approved equal.

## 2.11 CONTROL-CIRCUIT CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Encore Wire Corporation.
  2. General Cable; General Cable Corporation.
  3. Southwire Company.

- B. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- C. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.
- E. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.
  - 1. Smoke control signaling and control circuits.
  - 2. Circuit Integrity Cable: Twisted shielded pair with 100% coverage aluminum-foil polyester tape, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- F. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
  - 1. Low-Voltage Circuits: No. 16 AWG, minimum, in pathway.
  - 2. Multiconductor Armored Cable: NFPA 70, Type MC, copper conductors, Type TFN/THHN conductor insulation, copper drain wire, copper armor with outer jacket with red identifier stripe, NTRL listed for fire-alarm and cable tray installation, plenum rated.

## 2.12 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test twisted pair cables according to TIA-568-C.2.
- C. Cable will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Test cables on receipt at Project site.
  - 1. Test each pair of twisted pair cable for open and short circuits.

### 3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 16133 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.

### 3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
  - 1. Comply with TIA-568-C Series of standards.
  - 2. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
  - 3. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
  - 4. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
  - 5. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
  - 6. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
  - 7. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
  - 8. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
  - 9. Support: Do not allow cables to lie on removable ceiling tiles.
  - 10. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
  - 11. Provide strain relief.
  - 12. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
  - 13. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.
- C. Balanced Twisted Pair Cable Installation:
  - 1. Comply with TIA-568-C.2.
  - 2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.
- D. Installation of Control-Circuit Conductors:
  - 1. Install wiring in raceways.
  - 2. Comply with requirements specified in Section 16133 "Raceways and Boxes for Electrical Systems."
- E. Open-Cable Installation:
  - 1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
  - 2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 30 inches apart.

3. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.
- F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
  2. Install cabling after the flooring system has been installed in raised floor areas.
  3. Below each feed point, neatly coil a minimum of 72 inches of cable in a coil not less than 12 inches in diameter.
- G. Separation from EMI Sources:
1. Comply with BICSI TDDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
    - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inches.
    - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inches.
    - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inches.
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
    - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
    - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inches.
    - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inches.
  4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
    - a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
    - b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inches.
    - c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inches.
  5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inches.
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

### 3.4 REMOVAL OF CONDUCTORS AND CABLES

- A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

### 3.5 CONTROL-CIRCUIT CONDUCTORS

- A. Minimum Conductor Sizes:
  - 1. Class 1 remote-control and signal circuits; No 14 AWG.
  - 2. Class 2 low-energy, remote-control, and signal circuits; No. 14 AWG.
  - 3. Class 3 low-energy, remote-control, alarm, and signal circuits; No 12 AWG.

### 3.6 FIRESTOPPING

- A. Comply with requirements in Section 07840 "Through Penetration Firestopping"
- B. Comply with TIA-569-D, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping" Chapter.

### 3.7 GROUNDING

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For low-voltage control wiring and cabling, comply with requirements in Section 16126 "Grounding and Bonding for Electrical Systems."

### 3.8 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 16153 "Identification for Electrical Systems."

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

## **END OF SECTION**

## **SECTION 16126**

### **GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- 1. Section includes grounding and bonding systems and equipment, plus the following special applications:
- 2. Underground distribution grounding.
- 3. Ground bonding common with lightning protection system.
- 4. Foundation steel electrodes.
- 5. Overhead-line grounding.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
  - 1. Test wells.
  - 2. Ground rods.
  - 3. Ground rings.
  - 4. Grounding arrangements and connections for separately derived systems.
  - 5. Grounding for sensitive electronic equipment.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

##### **1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 01730 "Operation and Maintenance Data," include the following:
    - a. Plans showing as-built, dimensioned locations of system described in "Field Quality Control" Article, including the following:
      - 1) Test wells.
      - 2) Ground rods.
      - 3) Ground rings.

- 4) Grounding arrangements and connections for separately derived systems.
- 5) Grounding for sensitive electronic equipment.
- b. Instructions for periodic testing and inspection of grounding features at test wells, ground rings, and grounding connections for separately derived systems based on NETA MTS NFPA 70B.
  - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
  - 2) Include recommended testing intervals.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Certified by NETA.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with UL 467 for grounding and bonding materials and equipment.
- D. ANSI/IEEE Standard 142 Recommended for Practice for Grounding of Industrial and Commercial Power Systems.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. ABB (Electrification Products Division).
  - 2. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
  - 3. Burndy; Hubbell Incorporated, Construction and Energy.
  - 4. ILSCO.
  - 5. Siemens Industry, Inc., Energy Management Division.

### 2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

- B. Bare Copper Conductors:
  - 1. Solid Conductors: ASTM B3.
  - 2. Stranded Conductors: ASTM B8.
  - 3. Tinned Conductors: ASTM B33.
  - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
  - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
  - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
  - 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

## 2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
  - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- E. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- F. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- G. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- H. Conduit Hubs: Mechanical type, terminal with threaded hub.
- I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- J. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- K. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.



- L. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- M. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- N. Straps: Solid copper, copper lugs. Rated for 600 A.
- O. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- P. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- Q. Water Pipe Clamps:
  - 1. Mechanical type, two pieces with stainless-steel bolts.
    - a. Material: Die-cast zinc alloy.
    - b. Listed for direct burial.
  - 2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

## 2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet.
- B. Ground Plates: 1/4 inch (6 mm) thick, hot-dipped galvanized.

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
  - 1. Bury at least 30 inches below grade.
  - 2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
  - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 6 inches (150 mm) above finished floor unless otherwise indicated.

2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.
- F. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
  2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  3. Connections to Ground Rods at Test Wells: Bolted connectors.
  4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

### 3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

### 3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductor's level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

### 3.5 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
  2. Lighting circuits.
  3. Receptacle circuits.
  4. Single-phase motor and appliance branch circuits.
  5. Three-phase motor and appliance branch circuits.
  6. Flexible raceway runs.
  7. Armored and metal-clad cable runs.
  8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.
- H. Separately Derived System Grounding: Bond the case and neutral of each transformer directly to the nearest available effectively grounded structural metal member of the structure, the nearest available effectively grounded metal water pipe, or in accordance with the local electrical inspection department. Flexible conduit shall not be used as a ground path to a transformer.
- I. Metallic Fences: Comply with requirements of IEEE C2.
1. Grounding Conductor: Bare copper, not less than No. 8 AWG or as indicated on the drawings.
  2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

3. Barbed Wire: Strands shall be bonded to the grounding conductor.

### 3.6 FENCE GROUNDING

- A. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) or as indicated on the drawings except as follows:
  1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).
    - a. Gates and Other Fence Openings: Ground fence on each side of opening.
      - 1) Bond metal gates to gate posts.
      - 2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

### 3.7 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
  1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
  2. Use exothermic welds for all below-grade connections.

3. For grounding electrode system, install at least two rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 16143 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
  1. Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
  1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
  3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding and Bonding for Piping:
  1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- H. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- I. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
  1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
  2. Bury ground ring not less than 24 inches from building's foundation.
- J. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
  2. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- K. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
  2. Make connections with clean, bare metal at points of contact.
  3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
  5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

### 3.8 LABELING

- A. Comply with requirements in Division 16 Section "Electrical Identification" Article for instruction signs. The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

### 3.10 COORDINATION

- A. General: Coordinate installation of grounding connections for equipment with equipment installation work. Inspect grounding and bonding system conductors for tightness and proper installation.
- B. Connections: Use exothermic welds or irreversible compression products for connecting bonding and grounding conductors to ground rods, to counterpoise, structural steel, piping systems, and elsewhere where shown on Drawings. Provide all accessories required for a complete installation.

### 3.11 TESTING

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

## END OF SECTION

## SECTION 16129

### HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Steel slotted support systems.
  - 2. Aluminum slotted support systems.
  - 3. Nonmetallic slotted support systems.
  - 4. Conduit and cable support devices.
  - 5. Support for conductors in vertical conduit.
  - 6. Structural steel for fabricated supports and restraints.
  - 7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
  - 8. Fabricated metal equipment support assemblies.
- B. Related Requirements:
  - 1. Section 16148 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Slotted support systems, hardware, and accessories.
    - b. Clamps.
    - c. Hangers.
    - d. Sockets.
    - e. Eye nuts.
    - f. Fasteners.
    - g. Anchors.
    - h. Saddles.
    - i. Brackets.
  - 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: For fabrication and installation details for electrical hangers and support systems.
  - 1. Hangers. Include product data for components.
  - 2. Slotted support systems.

3. Equipment supports.
  4. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. For each area classification as defined in Section 16012 "Electrical General", submit a tabbed section for hangers and supports to be used in each area classification.

#### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Suspended ceiling components.
  2. Ductwork, piping, fittings, and supports.
  3. Structural members to which hangers and supports will be attached.
  4. Size and location of initial access modules for acoustical tile.
  5. Items penetrating finished ceiling, including the following:
    - a. Luminaires.
    - b. Air outlets and inlets.
    - c. Sprinklers.
    - d. Access panels.
- B. Seismic Qualification Data: Certificates, for hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

#### 1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M for Steel.
  2. AWS D1.2/D1.2M for Aluminum.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the supported equipment and systems will be fully operational after the seismic event."



2. Component Importance Factor: 1.5.
  3. Component Amplification Factor: 2.5.
  4. Component Response Modification Factor: 6.0.
- B. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame Rating: Class 1.
  2. Self-extinguishing according to ASTM D635.

## 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches on center in at least one surface.
1. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit; a part of Atkore International.
    - b. B-line, an Eaton business.
    - c. GS Metals Corp.
    - d. Thomas & Betts Corporation; A Member of the ABB Group.
    - e. Unistrut; Part of Atkore International.
    - f. Wesanco, Inc.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Material for Channel, Fittings, and Accessories: Hot-dip Galvanized steel or Stainless steel, Type 316.
  4. Channel Width: Selected for applicable load criteria.
  5. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch-diameter holes at a maximum of 8 inches on center in at least one surface.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Cooper Industries, Inc.
    - b. Thomas & Betts Corporation; A Member of the ABB Group.
    - c. Unistrut; Part of Atkore International.
  2. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
  3. Channel Material: 6063-T5 aluminum alloy.
  4. Fittings and Accessories Material: 5052-H32 aluminum alloy.
  5. Channel Width: Selected for applicable load criteria.
  6. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
  7. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
  8. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Conduit and Cable Support Devices: Hot-dipped, malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
  - 1. Clamps: Conduit clamps shall be hot-dipped, malleable-iron, one-hole straps with associated clamp backs.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
  - 1. Powder-Actuated Fasteners: Threaded stainless-steel stud, for use in hardened Portland cement concrete, steel or wood with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) Hilti, Inc.
      - 2) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 3) MKT Fastening, LLC.
      - 4) Simpson Strong-Tie Co., Inc.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
    - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      - 1) B-line, an Eaton business.
      - 2) Empire Tool and Manufacturing Co., Inc.
      - 3) Hilti, Inc.
      - 4) ITW Ramset/Red Head; Illinois Tool Works, Inc.
      - 5) MKT Fastening, LLC.
  - 3. Concrete Inserts: Hot-dipped steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325. Stainless steel.
  - 6. Toggle Bolts: All Stainless-steel springhead type.
  - 7. Hanger Rods: Threaded stainless-steel.

## 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Sheet Metal for Instrumentation Racks: 6061-T6 aluminum alloy.

- C. Materials: Comply with requirements in Section 05500 "Metal Fabrications" for steel shapes and plates.

## **PART 3 - EXECUTION**

### **3.1 APPLICATION**

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
  - 1. NECA 1.
  - 2. NECA 102 for aluminum conduit installations.
  - 3. NECA 105 for metal cable tray systems.
  - 4. NECA 111 for nonmetallic cable tray systems.
- B. Support systems shall be applied as specified below for each respective area classification as defined in Section 16012 "Electrical General".
- C. Outdoor Areas:
  - 1. Threaded fastening hardware, rods, channels, clamps, brackets and other support systems shall be stainless steel.
- D. Indoor Wet and/or Damp Areas:
  - 1. Threaded fastening hardware, rods, channels, clamps, brackets and other support systems shall be stainless steel.
- E. Corrosive Areas:
  - 1. Threaded fastening hardware, rods, channels, clamps, brackets and other support systems shall be stainless steel.
- F. Hazardous Areas:
  - 1. Threaded fastening hardware, rods, channels, clamps, brackets and other support systems shall be stainless steel.
- G. General Purpose Areas:
  - 1. Threaded fastening hardware, rods, channels, clamps, brackets and other support systems shall be stainless steel.
- H. Comply with requirements in Section 07840 "Through Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- I. Comply with requirements for raceways and boxes specified in Section 16133 "Raceways and Boxes for Electrical Systems."
- J. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and RMC as scheduled in NECA 1, where its Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

- K. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.

### 3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, raceways may be supported by openings through structure members, according to NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lbs.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.
  - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
  - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
  - 7. To Light Steel: Sheet metal screws.
  - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 05500 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03300 "Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
  - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Touchup: Comply with requirements in Section 09900 "Painting and Coating" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

**END OF SECTION**

## SECTION 16133

### RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings.
  - 2. Nonmetallic conduits and fittings.
  - 3. Metal wireways and auxiliary gutters.
  - 4. Nonmetal wireways and auxiliary gutters.
  - 5. Surface raceways.
  - 6. Boxes, enclosures, and cabinets.
- B. Related Requirements:
  - 1. Section 16012 "Electrical General" for area classifications.
  - 2. Section 16143 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.

##### 1.3 DEFINITIONS

- A. ARC: Aluminum rigid conduit.
- B. GRC: Galvanized rigid steel conduit.
- C. IMC: Intermediate metal conduit.
- D. EMT: Electrical metal tubing.
- E. FMC: Flexible metal conduit.
- F. LFMC: Liquid-tight flexible metal conduit.
- G. LFNC: Liquid-tight flexible nonmetallic conduit.
- H. RNC: Rigid nonmetallic conduit.
- I. RMC: Rigid metal conduit.
- J. RTRC: Reinforce thermosetting resin conduit (fiberglass).

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For raceways, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For the following raceway components. Contractor shall submit raceway layouts during the submittal process including, but not limited to, plans, elevations, sections, details, and attachments to other work.
  - 1. Custom enclosures and cabinets.
- C. For each area classification as defined in Section 16012 "Electrical General", submit a tabbed section for raceways and boxes to be used in each area classification.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  - 1. Structural members in paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Seismic Qualification Data: Certificates, for enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
  - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- C. Source quality-control reports.

#### 1.6 CONDUIT SCHEDULE

- A. Refer to conduit and wire schedule on plans for raceway sizing and routing descriptions.

#### 1.7 QUALITY ASSURANCE

- A. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
- B. Comply with NFPA 70.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS AND FITTINGS

#### A. Metal Conduit:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. AFC Cable Systems; a part of Atkore International.
  - b. Allied Tube & Conduit; a part of Atkore International.
  - c. Anamet Electrical, Inc.
  - d. Electri-Flex Company.
  - e. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - f. Southwire Company.
  - g. Thomas & Betts Corporation; A Member of the ABB Group.
  - h. Wheatland Tube Company.
2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. GRC: Comply with ANSI C80.1 and UL 6.
4. ARC: Comply with ANSI C80.5 and UL 6A.
5. IMC: Comply with ANSI C80.6 and UL 1242.
6. Coated Steel Conduit: PVC-coated GRC.
  - a. Comply with NEMA RN 1.
  - b. Coating Thickness: 0.040 inch, minimum.
7. EMT: Comply with ANSI C80.3 and UL 797.
8. FMC: Comply with UL 1; zinc-coated steel.
9. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

#### B. Metal Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - a. Allied Tube & Conduit; a part of Atkore International.
  - b. Anamet Electrical, Inc.
  - c. Electri-Flex Company.
  - d. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - e. Southwire Company.
  - f. Thomas & Betts Corporation; A Member of the ABB Group.
  - g. Wheatland Tube Company.
2. Comply with NEMA FB 1 and UL 514B.
3. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
4. Fittings, General: Listed and labeled for type of conduit, location, and use.
5. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
6. Fittings for EMT:
  - a. Material: Steel.
  - b. Type: compression.
7. Expansion Fittings:



- a. Hot dipped galvanized steel, complying with UL 514, rated for environmental conditions in areas where installed.
  - b. Exposed Runs: Expansion fittings shall be of the weatherproof type and shall be provided with an external bonding jumper. The expansion fittings shall allow for 4 inches of longitudinal movement and shall be designed so that when completely assembled the end of each conduit entering the fitting is bushed. O.Z. GEDNEY Type EX or approved equal.
  - c. Embedded runs: Expansion fittings shall be of the watertight and concrete-tight type and shall be provided with an internal bonding jumper. The expansion material shall be neoprene and shall allow for 0.75 inches of movement in any direction. Fittings shall be O.Z. GEDNEY Type DX.
- 8. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
- C. Joint Compound for IMC, GRC or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## 2.2 NONMETALLIC CONDUITS AND FITTINGS

- A. Nonmetallic Conduit:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. AFC Cable Systems; a part of Atkore International.
    - b. Anamet Electrical, Inc.
    - c. Arnco Corporation.
    - d. CANTEX INC.
    - e. Condux International, Inc.
    - f. Electri-Flex Company.
    - g. Lamson & Sessions.
    - h. RACO; Hubbell.
    - i. Thomas & Betts Corporation; A Member of the ABB Group.
  - 2. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 3. Fiberglass (RTRC):
    - a. Comply with NEMA TC 14.
    - b. Comply with UL 2515 for aboveground raceways.
    - c. Comply with UL 2420 for belowground raceways.
  - 4. ENT: Comply with NEMA TC 13 and UL 1653.
  - 5. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
  - 6. LFNC: Comply with UL 1660.
  - 7. Rigid HDPE: Comply with UL 651A.
  - 8. Continuous HDPE: Comply with UL 651A.

9. Coilable HDPE: Preassembled with conductors or cables, and complying with ASTM D3485.
  10. RTRC: Comply with UL 2515A and NEMA TC 14.
- B. Nonmetallic Fittings:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allied Tube & Conduit; a part of Atkore International
    - b. Anamet Electrical, Inc.
    - c. CANTEX, INC.
    - d. Champion Fiberglass, Inc.
    - e. Electri-Flex Company.
    - f. Kraloy.
    - g. RACO; Hubbell.
    - h. Thomas & Betts Corporation; A Member of the ABB Group.
  2. Fittings, General: Listed and labeled for type of conduit, location, and use.
  3. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
  4. Fittings for LFNC: Comply with UL 514B.
  5. Solvents and Adhesives: As recommended by conduit manufacturer.
  6. Expansion Fittings:
    - a. PVC, complying with UL 651, rated for environmental conditions where installed.
    - b. Fittings shall be of two-piece rigid PVC construction with internal O-ring to prevent the entrance of water and provide watertight seal. Fittings shall provide a minimum of 4" of longitudinal expansion in straight runs.

## 2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. B-line, an Eaton business.
  2. Hoffman; a brand of nVent.
  3. Square D.
- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 12 unless otherwise indicated, and sized according to NFPA 70.
1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Hinged type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

## 2.4 NONMETALLIC WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Hoffman; a brand of nVent.
  - 2. Lamson & Sessions.
- B. Listing and Labeling: Nonmetallic wireways and auxiliary gutters shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fiberglass: Fiberglass polyester, extruded and fabricated to required size and shape, without holes or knockouts. Cover shall be gasketed with oil-resistant gasket material and fastened with captive screws treated for corrosion resistance. Connections shall be flanged and have stainless-steel screws and oil-resistant gaskets.
- D. PVC: PVC, extruded and fabricated to required size and shape, and having snap-on cover, mechanically coupled connections, and plastic fasteners.
- E. Fittings and Accessories: Couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings shall match and mate with wireways as required for complete system.
- F. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.5 SURFACE RACEWAYS

- A. Listing and Labeling: Surface raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Engineer.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell Incorporated; Wiring Device-Kellems.
    - b. Panduit Corp.
    - c. Wiremold / Legrand.
- C. Surface Nonmetallic Raceways: Two- or three-piece construction, complying with UL 5A, and manufactured of rigid PVC with texture and color selected by Engineer from manufacturer's standard colors. Product shall comply with UL 94 V-0 requirements for self-extinguishing characteristics.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Hubbell Incorporated.
    - b. Panduit Corp.

c. Wiremold / Legrand.

2.6 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Crouse-Hinds, an Eaton business.
  - 2. EGS/Appleton Electric.
  - 3. Erickson Electrical Equipment Company.
  - 4. Hoffman; a brand of nVent.
  - 5. Hubbell Incorporated.
  - 6. RACO; Hubbell.
  - 7. Spring City Electrical Manufacturing Company.
  - 8. Thomas & Betts Corporation; A Member of the ABB Group.
- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- E. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb. (23 kg) shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Gangable boxes are prohibited.
- K. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 12 with continuous-hinge cover with flush latch unless otherwise indicated.
  - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Nonmetallic Enclosures: Plastic.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- L. Cabinets:
  - 1. NEMA 250, Type 12 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.

2. Hinged door in front cover with flush latch and concealed hinge.
  3. Key latch to match panelboards.
  4. Metal barriers to separate wiring of different systems and voltage.
  5. Accessory feet where required for freestanding equipment.
  6. Nonmetallic cabinets shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- M. Fittings and boxes in hazardous places shall be:
1. Rated for Class 1, Division 1 or 2 to match Area Classification and made from copper free aluminum.
  2. Conduit fittings shall be rigid steel or PVC coated rigid steel. Seal fittings for hazardous areas shall be CROUSE HINDS EYE or EYSEF as required for proper fill.
  3. All metallic hardware (hinges, screws, bolts, etc.) shall be type 316 stainless steel.
- N. Fittings and Boxes in CORROSIVE AREAS:
1. Non-metallic or stainless steel for unclassified areas.
  2. PVC coated copper free aluminum for Class 1, Division 1 areas.
  3. Stainless steel or copper free aluminum for Class 1, Division 2 areas.
  4. All metallic hardware (hinges, screws, bolts, etc.) shall be type 316 stainless steel.

## **PART 3 - EXECUTION**

### **3.1 RACEWAY APPLICATION**

- A. Raceways shall be applied as specified below for each respective area classification as defined in Section 16012 "Electrical General".
- B. Outdoor Areas:
1. Conduit entrances shall be threaded, and fittings shall have gasketed covers.
  2. Threaded fastening hardware and rods shall be stainless steel. Raceway supports such as channel, clamps and brackets shall be stainless steel.
  3. Exposed Conduit: GRC.
  4. Concealed Conduit, Aboveground: GRC.
  5. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
    - a. Sweeps and risers for transition of PVC from below grade to above grade shall be GRC wrapped with corrosion resistant tape or RTRC.
  6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  7. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R stainless steel unless otherwise indicated.
- C. Indoor Wet and/or Damp Areas:
1. Conduit entrances shall be threaded, and fittings shall have gasketed covers.
  2. Threaded fastening hardware and rods shall be stainless steel. Raceway supports such as channel, clamps and brackets shall be stainless steel.
  3. Boxes and Enclosures: NEMA 250, Type 4X, stainless steel.
  4. Device boxes shall be cast, copper free aluminum.

5. Exposed, Not Subject to Physical Damage: GRC
  6. Exposed, Not Subject to Severe Physical Damage: GRC
  7. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
    - a. Areas below 6'0"
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
  8. Concealed in Ceilings and Interior Walls and Partitions: EMT or RNC, Type EPC-40-PVC.
  9. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  10. Boxes and Enclosures: NEMA 250, Type 4X stainless steel.
- D. Corrosive Areas: Apply raceway products as specified below unless otherwise indicated.
1. Exposed Conduit: RNC, Type EPC-80-PVC.
  2. Concealed, Raceway: RNC, Type EPC-40-PVC.
  3. Raceway supports such as channel, clamps and brackets shall be stainless steel.
  4. Threaded fastening hardware and rods shall be stainless steel.
  5. Boxes and Enclosures: NEMA 250, Type 4X stainless steel or non-metallic unless otherwise indicated.
- E. Hazardous Areas:
1. Hazardous areas shall have electrical installations which conform to Class and Division as shown on the drawings or as defined by the NEC and NFPA 820.
  2. Provide seal fittings per NEC requirements.
  3. Exposed Conduit: GRC
  4. Exposed Conduit in Corrosive and Hazardous Areas: PVC-coated rigid steel conduit.
  5. Boxes and Enclosures: Shall be determined by area requirements.
  6. Raceway Supports:
    - a. Threaded fastening hardware and rods shall be stainless steel. Raceway supports such as channel, clamps and brackets shall be stainless steel.
- F. General Purpose Areas:
1. Exposed Conduit: GRC or IMC.
  2. Conduit Concealed in Walls or Ceilings: For general purpose lighting and receptacle circuits, conduit may be EMT.
  3. Boxes and Enclosures: Exposed boxes shall be cast, copper free aluminum, type FS/FD. Concealed boxes may be NEMA 1. Boxes poured in concrete shall be cast.
- G. Minimum Raceway Size:
1. Aboveground: 3/4-inch trade size.
  2. Underground: 1-inch trade size.
- H. Raceway Fittings: Compatible with raceways and suitable for use in area classification and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
  3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
  4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- I. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
  - J. Motor feeders sourced from VFC's not utilizing shielded power cable shall be rigid metal conduit.
  - K. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
  - L. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

### 3.2 INSTALLATION

- A. Comply with requirements in Section 16129 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- F. Conceal all general receptacle and lighting raceways within finished walls, ceilings and floors.
- G. Complete raceway installation before starting conductor installation.
- H. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- I. Install no more than the equivalent of three 90-degree bends in any conduit run. Support within 12 inches of changes in direction.

- J. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- K. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- L. Support conduit within 12 inches of enclosures to which attached.
- M. Raceways Embedded in Slabs:
  - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
  - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
  - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
  - 4. Do not embed threadless fittings in concrete unless specifically approved by Engineer for each specific location.
  - 5. Change from RNC, Type EPC-40-PVC to GRC before rising above floor.
- N. Stub-Ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- O. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- P. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- Q. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- R. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch-trade size and insulated throat metal bushings on 1-1/2-inch-trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- S. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- T. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- U. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.



- V. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- W. Surface Raceways:
1. Install surface raceway with a minimum 2-inch radius control at bend points.
  2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48 inches and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- X. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.
- Y. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
  2. Where an underground service raceway enters a building or structure.
  3. Conduit extending from interior to exterior of building.
  4. Conduit extending into pressurized duct and equipment.
  5. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
  6. Where otherwise required by NFPA 70.
- Z. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- AA. Expansion-Joint Fittings:
1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F and that has straight-run length that exceeds 25 feet. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F and that has straight-run length that exceeds 100 feet.
  2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
    - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
    - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
    - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
    - d. Attics: 135 deg F temperature change.
  3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least

0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.

4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

BB. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations subject to severe physical damage.
2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

CC. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

DD. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.

EE. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.

FF. Locate boxes so that cover or plate will not span different building finishes.

GG. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

HH. Set metal floor boxes level and flush with finished floor surface.

II. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

JJ. SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

1. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 16144 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### 3.3 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07840 "Through Penetration Firestopping."

### 3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

### 3.5 FIELD INSPECTION

- A. Prior to backfilling and encasing conduits installed underground or covering conduits concealed in walls and ceilings, all raceways shall be inspected by the Engineer. Engineer shall be contacted a minimum of one week in advance for field inspection of concealed raceway. No raceway shall be concealed or backfilled until inspected by the Engineer. Prior to the Engineer inspection, the conduits to be inspected shall bear some type of marking indicating what the conduit is, in relation to the conduit and wire schedule; the marking may be tape with writing or simply writing directly on the conduit. Marking the conduit is the Contractor's responsibility.

**END OF SECTION**

## SECTION 16143

### UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
  - 2. Rigid nonmetallic duct.
  - 3. Flexible nonmetallic duct.
  - 4. Duct accessories.
  - 5. Precast concrete vaults.
  - 6. Precast concrete handholes.
  - 7. Polymer concrete handholes and boxes with polymer concrete cover.
  - 8. Fiberglass handholes and boxes with polymer concrete cover.
  - 9. Fiberglass handholes and boxes.
  - 10. High-density plastic boxes.
  - 11. Precast manholes.
  - 12. Cast-in-place manholes.
  - 13. Utility structure accessories.

##### 1.3 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
  - 1. Two or more ducts installed in parallel, with or without additional casing materials.
  - 2. Multiple duct banks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. RTRC: Reinforced thermosetting resin conduit.
- F. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include duct-bank materials, including spacers and miscellaneous components.
  - 2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
  - 3. Include accessories for manholes, handholes, boxes and vaults.
  - 4. Include underground-line warning tape.
- B. Shop Drawings:
  - 1. Precast or Factory-Fabricated Underground Utility Structures:
    - a. Include plans, elevations, sections, details, attachments to other work, and accessories.
    - b. Include duct entry provisions, including locations and duct sizes.
    - c. Include reinforcement details.
    - d. Include frame and cover design and manhole chimneys.
    - e. Include ladder details.
    - f. Include grounding details.
    - g. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
    - h. Include joint details.
  - 2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
    - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
    - b. Include duct entry provisions, including locations and duct sizes.
    - c. Include cover design.
    - d. Include grounding details.
    - e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
  - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
  - 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Qualification Data: For professional engineer and testing agency responsible for testing
- C. Product Certificates: For concrete and steel used in precast concrete manholes, vaults and handholes, as required by ASTM C858.
- D. Source quality-control reports.
- E. Field quality-control reports.

## 1.6 MAINTENANCE MATERIALS SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Furnish cable-support stanchions, arms, insulators, and associated fasteners in quantities equal to 5 percent of quantity of each item installed.

## 1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

## 1.8 FIELD CONDITIONS

- A. Ground Water: Assume ground-water level is 36 inches below ground surface unless a higher water table is noted on Drawings.

# PART 2 - PRODUCTS

## 2.1 METAL CONDUIT AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Allied Tube & Conduit; a part of Atkore International.
  - 2. Anamet Electrical, Inc.
  - 3. O-Z/Gedney; a brand of Emerson Industrial Automation.
  - 4. Southwire Company.
  - 5. Thomas & Betts Corporation; A Member of the ABB Group.
  - 6. Wheatland Tube Company.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. Coated Steel Conduit: PVC-coated GRC.
  - 1. Comply with NEMA RN 1.
  - 2. Coating Thickness: 0.040 inch, minimum.
- D. Re-galvanizing Coatings: Galv-Weld as manufactured by Unibraze Corporation, Gal-Van-Ize as manufactured by LAWSON Products, Inc.
- E. Below Grade Sealants: BITUMASTIC or brush applied ROB-ROY coating. Spray on products shall not be allowed.
- F. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## 2.2 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Underground RTRC Duct: Comply with NEMA TC 14 and UL 2420 for underground raceways.
- C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. CANTEX INC.
  - 2. Carlon
  - 3. Champion Fiberglass, Inc.
  - 4. Cresline Plastic Pipe Co., Inc.
  - 5. Allied Tube & Conduit, a part of Atkore International.
- D. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.
- E. Solvents and Adhesives: As recommended by conduit manufacturer.

## 2.3 FLEXIBLE NONMETALLIC DUCTS

- A. HDPE Duct: Type EPEC-40 HDPE, complying with NEMA TC 7 and UL 651A.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Carlon; a brand of Thomas & Betts Corporation.
    - b. Opti-Com Manufacturing Network, Inc (OMNI).
  - 2. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

## 2.4 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. CANTEX INC.
    - b. Carlon; a brand of Thomas & Betts Corporation.
    - c. IPEX USA LLC.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 16153 "Identification for Electrical Systems."

## 2.5 PRECAST CONCRETE VAULTS

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Oldcastle Infrastructure; a CRH company.
  - 2. Utility Concrete Products, LLC.
- C. Comply with ASTM C858 for design and manufacturing processes.
- D. Frame and Cover: Weatherproof steel frame, with hinged galvanized steel access door assembly with tamper-resistant, captive, cover-securing bolts, and spring-assisted opening mechanism.
  - 1. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - 2. Cover Handle: Recessed.
  - 3. Springs: Stainless Steel, Type 316.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Molded lettering, as indicated on the drawings.
- G. Configuration: Units shall be designed for flush burial and have integral closed bottom unless otherwise indicated.
- H. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
  - 1. Extension shall provide increased depth of 12 inches.
  - 2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
- I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- J. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
  - 1. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
  - 2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
  - 3. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
  - 4. Knockout panels shall be 1-1/2 to 2 inches thick.



- K. Vaults shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.6 PRECAST CONCRETE HANDHOLES AND BOXES

- A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Oldcastle Infrastructure; a CRH company.
  - 2. Utility Concrete Products, LLC.
- C. Comply with ASTM C858 for design and manufacturing processes.
- D. Frame and Cover: Weatherproof steel frame, with hinged galvanized steel access door assembly with tamper-resistant, captive, cover-securing bolts.
  - 1. Cover Hinges: Concealed, with hold-open ratchet assembly.
  - 2. Cover Handle: Recessed.
- E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- F. Cover Legend: Molded lettering, as indicated on the drawings.
- G. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- H. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
  - 1. Extension shall provide increased depth of 12 inches.
  - 2. Slab: Same dimensions as bottom of enclosure, and arranged to provide closure.
- I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
- J. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

## 2.7 HANDHOLES AND BOXES

- A. Polymer Concrete Handholes: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Fiberglass Handholes: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.

- C. High Density Plastic Handholes: Injection molded of HDPE or copolymer-polypropylene. Cover shall be made of polymer concrete.
- D. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Armorcast Products Company.
  - 2. MacLean Highline.
  - 3. NewBasis.
  - 4. Oldcastle Infrastructure; a CRH company.
  - 5. Quazite: Hubbell Power Systems, Inc.
- E. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- F. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
- G. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- H. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- I. Cover Legend: Molded lettering, as indicated on the drawings.
- J. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- K. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
- L. Handholes shall have factory-installed inserts for cable racks and pulling-in irons.

## 2.8 PRECAST MANHOLES

- A. Description: One-piece units and units with interlocking mating sections, complete with accessories, hardware, and features.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Oldcastle Precast, Inc.
  - 2. Utility Concrete Products, LLC.
- C. Comply with ASTM C858.
- D. Structural Design Loading: Comply with requirements in "Underground Enclosure Application" Article.

- E. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
  - 1. Knockout panels shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
  - 2. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct.
  - 3. Knockout panel shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
  - 4. Knockout panels shall be 1-1/2 to 2 inches (38 to 50 mm) thick.
- F. Ground Rod Sleeve: Provide a 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the duct entering the structure.
- G. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

## 2.9 UTILITY STRUCTURE ACCESSORIES

- A. Accessories for Utility Structures: Utility equipment and accessory items used for utility structure access and utility support, listed and labeled for intended use and application.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Neenah Foundry Company.
  - 2. Utility Concrete Products, LLC.
- C. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
  - 1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A48/A48M, Class 35B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
    - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
    - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
  - 2. Cover Legend: Cast in. Selected to suit system.
    - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
    - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
  - 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
    - a. Seal joints watertight using preformed plastic or rubber complying with ASTM C990. Install sealing material according to sealant manufacturers' written instructions.

- D. Manhole Sump Frame and Grate: ASTM A48/A48M, Class 30B, gray cast iron.
- E. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch-diameter eye, and 1-by-4-inch bolt.
  - 1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.
- F. Pulling-in and Lifting Irons in Concrete Floors: 7/8-inch-diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
  - 1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
- G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
  - 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
- H. Ground Rod Sleeve: 3-inch PVC sleeve in manhole floors 2 inches from the wall adjacent to, but not underneath, the ducts routed from the facility.
- I. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- J. Cable Rack Assembly: Steel, hot-dipped galvanized, except insulators.
  - 1. Stanchions: T-section or channel with provisions to connect to other sections or channels to form a continuous unit; 1-1/2 inches in width by nominal 24 inches long; punched with 14 hook holes on 1-1/2-inch centers for cable-arm attachment.
  - 2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
  - 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- K. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
  - 1. Stanchions: Nominal 36 inches high by 4 inches wide, with provisions to connect to other sections to form a continuous unit, with minimum of nine holes for arm attachment.
  - 2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.

- L. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduit, conduit and duct coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- M. Fixed Manhole Ladders: Arranged for attachment to wall and floor of manhole. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.
- N. Portable Manhole Ladders: UL-listed, heavy-duty fiberglass specifically designed for portable use for access to electrical manholes. Minimum length equal to distance from deepest manhole floor to grade plus 36 inches. One required.
- O. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

## 2.10 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C1037.
- B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
  - 1. Tests of materials shall be performed by an independent testing agency.
  - 2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
  - 3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Engineer if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by the Engineer.
- C. Clear and grub vegetation to be removed, and protect vegetation to remain according to Section 02230 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 02230 "Site Clearing."

### 3.2 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.
- C. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- D. Bored Underground Duct: Type EPEC-40-HDPE unless otherwise indicated.
- E. Underground Ducts Crossing paved paths, walkways, driveways, roadways and railroads: Type EPC-40 PVC RNC, encased in reinforced concrete.
- F. Stub-ups: GRC or RTRC.

### 3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
  - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
  - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
  - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 structural load rating.
  - 4. Units Subject to Light-Duty Pedestrian Traffic Only: High-density plastic, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
  - 5. Cover design load shall not exceed the design load of the handhole or box.
- B. Manholes: Precast concrete.
  - 1. Units Located in Roadways and Other Deliberate Traffic Paths by Heavy or Medium Vehicles: H-20 structural load rating according to AASHTO HB 17.
  - 2. Units Not Located in Deliberate Traffic Paths by Heavy or Medium Vehicles: H-10 load rating according to AASHTO HB 17.

### 3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 02324 "Backfill and Compacting for Utilities," but do not use heavy-duty, hydraulic-operated, compaction equipment.
  - 1. Excavated material shall be examined to be acceptable for backfill by the Engineer. If deemed not acceptable, then borrow material which possesses a 1/2-inch screen shall be used. Six inches of backfill shall be required above and below conduit or direct buried cable installation.

- B. Restoration: Replace area after construction vehicle traffic in immediate area is complete.
- C. Restore surface features at areas disturbed by excavation, and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 02910 "Planting".

### 3.5 DUCT AND DUCT BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
  - 1. Duct shall have maximum of two 90-degree bends or the total of all bends shall be no more than 180 degrees between pull points.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.
- G. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches on center for 4-inch duct, and vary proportionately for other duct sizes.
  - 1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.
  - 2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install

an expansion fitting near the center of all straight-line duct with calculated expansion of more than 3/4-inch.

- H. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 16144 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- I. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- J. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts. Leave at least 12 inches of slack at each end of pull cord.
- K. Separation from Other Utilities: Underground electrical conduit shall be kept 3'-0" horizontally and 1'-0" vertically at crossings from other underground utilities except telephone.
- L. Concrete-Encased Ducts and Duct Bank:
  - 1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 02324 "Backfilling and Compacting for Utilities" for pipes less than 6 inches in nominal diameter.
  - 2. Width: Excavate trench 12 inches wider than duct on each side.
  - 3. Width: Excavate trench 3 inches wider than duct on each side.
  - 4. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
  - 5. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
  - 6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
  - 7. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
  - 8. Minimum Space Between Duct: Underground electrical power feeders shall be separated by a minimum of 7-1/2 inch spacing on center. Control and instrumentation conduits shall maintain a minimum of 2 inches of separation between conduit walls.
  - 9. Elbows: Use manufactured GRC or RTRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
    - a. Couple RNC duct to GRC or RTRC with adapters or solvents designed for this purpose, and encase coupling with 3 inches of concrete.



- b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
      - 1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.
    - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
      - 1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.
  - 10. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
  - 11. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
  - 12. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
  - 13. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    - a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions, or use other specific measures to prevent expansion-contraction damage.
    - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
  - 14. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03300 "Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation application.

**M. Direct-Buried Duct and Duct Bank:**

- 1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 02324 "Backfilling and Compacting for Utilities" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
- 2. Width: Excavate trench 12 inches wider than duct on each side.
- 3. Depth: Install top of duct at least 24 inches below finished grade unless otherwise indicated.
- 4. Set elevation of bottom of duct bank below frost line.
- 5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.

6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Minimum Spacing Between Ducts: Underground electrical power feeders shall be separated by a minimum of 7-1/2 inch spacing on center. Control and instrumentation conduits shall maintain a minimum of 2 inches of separation between conduit walls.
8. Stub-ups: Install manufactured GRC or RTRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
  - a. Couple RNC duct to GRC with adapters designed for this purpose and encase coupling with 3 inches of concrete.
  - b. Stub-ups to Outdoor Equipment on Concrete Bases: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.
  - c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
    - 1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.
9. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 02324 "Backfilling and Compacting for Utilities" for installation of backfill materials.
  - a. Place minimum 6 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.

- N. Underground-Line Warning Tape: Bury detectable underground line specified in Section 16153 "Identification for Electrical Systems" no less than 12 inches above all concrete-encased duct and duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally. A separate detectable warning tape is to be installed directly above PVC conduits which have been installed as spares, for future location of the conduit.

### 3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

- A. Cast-in-Place Manhole Installation:
  1. Finish interior surfaces with a smooth-troweled finish.

2. Knockouts for Future Duct Connections: Form and pour concrete knockout panels 1-1/2 to 2 inches thick, arranged as indicated.
  3. Comply with requirements in Section 03300 "Cast-in-Place Concrete" for cast-in-place concrete, formwork, and reinforcement.
- B. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C891 unless otherwise indicated.
  2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
  3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevations:
1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
  2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
  3. Install handholes with bottom below the frost line.
  4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
  5. Where indicated, cast handhole cover frame integrally with handhole structure.
- D. Drainage: Install drains in bottom of manholes where indicated. Coordinate with drainage provisions indicated.
- E. Manhole Access: Circular opening in manhole roof; sized to match cover size.
1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
  2. Install chimney, constructed of precast concrete collars and rings, to support cast-iron frame to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for frame to chimney.
- F. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.
- G. Damp proofing: Apply damp proofing to exterior surfaces of manholes after concrete has cured at least three days. Damp proofing materials and installation are specified in Section 071113 "Bituminous Damp proofing." After ducts are connected and grouted, and before backfilling, dampproof joints and connections, and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.
- H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.

- I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- J. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

### 3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below frost line.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
  - 1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Section 03300 "Cast-in-Place Concrete," with a troweled finish.
  - 2. Dimensions: 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep).

### 3.8 GROUNDING

- A. Ground underground ducts and utility structures according to Section 16126 "Grounding and Bonding for Electrical Systems."

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspection as specified in Section 16670 "Electrical Testing".

### 3.10 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump.
  - 1. Sweep floor, removing dirt and debris.
  - 2. Remove foreign material.

**END OF SECTION**

## **SECTION 16144**

### **SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
  - 5. Silicone sealants.
- B. Related Requirements:
  - 1. Section 07840 "Through Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Coordination Drawings: Sleeve and sleeve seal penetration plans including pipe sleeves and rectangular sleeves and forms, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
  - 1. Structural members in the paths of conduit groups.
  - 2. Sleeve materials, size and spacing.
  - 3. When using rectangular forms, coordinate with the Engineer and revise structural members as determined by the Engineer to ensure structural integrity.

#### **PART 2 - PRODUCTS**

##### **2.1 SLEEVES**

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
  - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:  
Galvanized-steel sheet; 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than 50 inches and with no side larger than 16 inches, thickness shall be 0.052 inch.
    - b. For sleeve cross-section rectangle perimeter 50 inches or more and one or more sides larger than 16 inches, thickness shall be 0.138 inch.

## 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Advance Products & Systems, Inc.
    - b. CALPICO, Inc.
    - c. Metraflex Company (The).
    - d. Pipeline Seal and Insulator, Inc.
    - e. GPT an EnPro Industries, Inc. Company.
  - 2. Sealing Elements: Interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
    - a. General Purpose: EPDM rubber.
    - b. Soil with Hydrocarbons: Nitrile (Buna N) rubber.
  - 3. Pressure Plates: Reinforced nylon polymer.
  - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. HOLDRITE; Reliance Worldwide Company.

## 2.4 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 07920 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.



- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using galvanized steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems where indicated. in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### 3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

**END OF SECTION**

## **SECTION 16153**

### **IDENTIFICATION FOR ELECTRICAL SYSTEMS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Color and legend requirements for raceways, conductors, and warning labels and signs.
  - 2. Labels.
  - 3. Bands and tubes.
  - 4. Tapes and stencils.
  - 5. Tags.
  - 6. Signs.
  - 7. Cable ties.
  - 8. Paint for identification.
  - 9. Fasteners for labels and signs.

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

#### **PART 2 - PRODUCTS**

##### **2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.

- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Comply with NFPA 70E and Section 16677 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Raceways and Cables Carrying Circuits at 600 V or Less:
  - 1. Black letters on an orange field.
  - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
  - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
  - 2. Insulation on phase conductor sizes AWG No. 10 and smaller shall be colored, No. 8 AWG and larger may have black insulation with self-adhesive vinyl tape of the appropriate color from the table below.
  - 3. Insulation on the grounded conductor (neutral) sizes AWG No. 8 and smaller shall be colored, AWG No. 6 and larger may have black insulation with self-adhesive vinyl tape of white or gray in accordance with the table below.
- C. Color-Coding for Power and Control Conductors, 600V or Less: Wiring shall conform to the following color code. Colors specified in table below are those generally used for phase conductors at this voltage.

Description	208/120	120/240	480/277	Control
Phase A (Left)	Black	Black	Brown	--
Phase B (Center)	Red	Red	Orange	--
Phase C (Right)	Blue	Blue	Yellow	--
Neutral	White	White	Gray	White
Ground	Green	Green	Green	Green

120V Control	--	--	--	Red
DC Control (+)	--	--	--	Blue
DC Control (-)	--	--	--	Gray
External Source	--	--	--	Orange

- D. Raceways and Cables Carrying Circuits at More Than 600 V:
1. Black letters on an orange field.
  2. Legend: "DANGER - CONCEALED HIGH VOLTAGE WIRING."
- E. Warning Label Colors:
1. Identify system voltage with black letters on an orange background.
  2. Black letters on an orange background with black letters on a white background for the message panel.
- F. Warning labels and signs shall include, but are not limited to, the following legends:
1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES"
- G. Equipment Identification Labels:
1. White letters on a black field.

## 2.3 LABELS

- A. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather, chemical and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Graphic Products.
  2. Minimum Nominal Size:
    - a. 3-1/2 by 5 inches for equipment.
    - b. 4 by 6 inches for arc flash labels.
    - c. As required by authorities having jurisdiction.

## 2.4 BANDS AND TUBES

- A. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tubes with machine-printed identification labels, sized to suit diameter and shrunk to fit firmly. Full shrink recovery occurs at a maximum of 200 deg F. Comply with UL 224.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Panduit Corp.
    - c. Thomas & Betts.
    - d. HellermannTyton.
- B. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Emedco.
    - d. Marking Services, Inc.
- C. Floor Marking Tape: 2-inch-wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Carlton Industries, LP.
    - b. Seton Identification Products.
    - c. Brady Corporation.
- D. Underground-Line Warning Tape:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Marking Services, Inc.
    - c. Seton Identification Products.
  - 2. Tape:
    - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
    - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
    - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
  - 3. Color and Printing:

- a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
  - b. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
  - c. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.
- 4. Tag:
  - a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, continuous-printed on one side with the inscription of the utility, compounded for direct-burial service.
  - b. Width: 3 inches.
  - c. Overall Thickness: 5 mils.
  - d. Foil Core Thickness: 0.35 mil.
  - e. Weight: 28 lb./1000 sq. ft.
  - f. Tensile according to ASTM D882: 70 lbf and 4600 psi.

## 2.5 TAGS

- A. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Seton Identification Products.

## 2.6 SIGNS

- A. Baked-Enamel Signs:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Carlton Industries, LP.
    - b. Champion America.
    - c. Emedco.
    - d. Marking Services, Inc.
  - 2. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.
  - 3. 1/4-inch grommets in corners for mounting.
  - 4. Nominal Size: 7 by 10 inches.
- B. Metal-Backed Butyrate Signs:
  - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Champion America.

- c. Marking Services, Inc.
  - 2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
  - 3. 1/4-inch grommets in corners for mounting.
  - 4. Nominal Size: 10 by 14 inches.
- C. Laminated Acrylic or Melamine Plastic Signs:
- 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Brady Corporation.
    - b. Carlton Industries, LP.
    - c. Marking Services, Inc.
  - 2. Engraved legend.
  - 3. Thickness:
    - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
    - b. For signs larger than 20 sq. in., 1/8 inch thick.
    - c. Engraved legend with black letters on white face.
    - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
    - e. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.
    - f. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

## 2.7 CABLE TIES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. HellermannTyton.
  - 2. Panduit Corp.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
  - 3. Temperature Range: Minus 40 to plus 185 deg F.
  - 4. Color: Black.

- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
  - 1. Minimum Width: 3/16 inch.
  - 2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
  - 3. UL 94 Flame Rating: 94V-0.
  - 4. Temperature Range: Minus 50 to plus 284 deg F.
  - 5. Color: Black.

## 2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.
- B. Heat Shrink Identification Products: Before applying products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### 3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, operation and maintenance manual, 29 CFR 1910.145, and with those required by applicable codes and standards. Use consistent designations throughout Project.
- ~~B.~~ Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Coordinate installation of identifying devices with location of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Verify identity of each item before installing identification products.
- E. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- F. Apply identification devices to surfaces that require finish after completing finish work.



- G. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- J. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- K. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- L. Painting Identification: Comply with requirements in Painting Sections for surface preparation and paint application.
- M. Aluminum ID tags shall not be used in rooms where chlorine, or like substance, is present.
- N. Heat-Shrink, Preprinted Tubes: Secure tight to surface at a location with high visibility and accessibility.
- O. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
- P. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in enclosures where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- Q. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- R. Underground Line Warning Tape:
  - 1. During backfilling of trenches, install continuous underground line warning tape for power, lighting, communication, control wiring and optical fiber cable as specified in Section 16143 "Underground Ducts and Raceways for Electrical Systems".
- S. Metal Tags:
  - 1. Place in a location with high visibility and accessibility.
  - 2. Secure using cable ties appropriate for the location.
- T. Baked-Enamel Signs:

1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.
- U. Laminated Acrylic or Melamine Plastic Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
  2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- V. Cable Ties: General purpose for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
  2. In Spaces Handling Environmental Air: Plenum rated.

### 3.3 IDENTIFICATION SCHEDULE

- A. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.
- B. All wiring in industrial machines and equipment shall be in accordance with NFPA 79. Notify Owner of any deficiencies noted during installation.
- C. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil. Stencil legend "DANGER - CONCEALED HIGH-VOLTAGE WIRING" with 3-inch-high, black letters on 20-inch centers.
- D. Locate identification at changes in direction, at penetrations of walls and floors, and at 30-foot maximum intervals.
- E. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Identify with metal tags.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
  2. Provide tags for all raceways identified in conduit and wire schedules.
  3. Locate identification at each end of raceway and at penetrations of walls, floors, enclosures, vaults and handholes.
- F. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits: Identify with metal tags.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
  2. Provide tags for all raceways identified in conduit and wire schedules.
  3. Locate identification at each end of raceway and at penetrations of walls, floors, enclosures, vaults and handholes.

- G. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
1. "EMERGENCY POWER."
  2. "POWER."
  3. "UPS."
- H. Power-Circuit and Control Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify the phase in conformance with the color-coding legend requirements of Part 2.
1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
  2. All control wiring in control panels or other enclosures that is powered from an external source and is not disconnected by the control panel disconnect shall be terminated at a disconnecting terminal block upon entering the enclosure. The color of the wire shall then be changed to yellow to identify it as being powered from an external source. Provide identification nameplate on the exterior of the enclosure to indicate sources of external power.
- I. Power-Circuit Conductor Identification, More Than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic preprinted tags colored and marked to indicate phase, and a separate tag with the circuit designation.
- J. Wire Marking:
1. All power and control conductors (including conductors in instrument and relay compartments of motor control centers, control panels, instrument panels, field panels and control stations, as well as connections to mechanical equipment), shall be tagged at each end with legible, pre-printed heat-shrink tubes showing the complete wire designation.
  2. Wire marking lettering shall be bold and type written.
  3. Wiring within a single enclosure shall be marked with the basic wire and terminal number at each end.
  4. All field wiring for controls shall have wire labels at each end. The labels shall be marked with the output terminal number at the source ~~original~~ equipment (control panel, MCP or MCC), the remote device terminal number (if applicable) and tag name separated by a slash.
  5. Examples:
    - a. A control cable from the Main Control Panel (MCP) terminal #X102 to the pump 101 check valve limit switch (ZS-101) the wire tag number at both ends shall be X102 / ZS-101.
    - b. A control cable from the MCP to a local control panel terminal #Y102, to terminal #24 in LCP-200, the wire tag number at both ends shall be Y102 / 24-LCP200
    - c. A control cable from the MCP terminal #H32 to the NMCC1 terminal #6, the tag number at both ends shall be H32 / 6-NMCC1.
    - d. A control cable from the NMCC1 terminal #C4 to device ZS-101, the wire tag number at both ends shall be C4-NMCC1 / ZS-101.
  6. Spare wiring shall be identified at each end with "SP#" and remote equipment number.

- a. Example: For two spare control cables from the Main Control Panel (MCP) terminal to the local control panel (LCP-202), the wire tag number at the LCP shall be SP1 / MCP and SP2 / MCP. The tag number at the MCP shall be SP1 / LCP202 and SP2 / LCP202.
- K. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- L. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, control wiring and optical-fiber cable. Install as directed in section 16143 “Underground Ducts and Raceways for Electrical Systems”
- M. Concealed Raceways and Duct Banks, More Than 600 V, within Buildings: Apply floor marking tape to the following finished surfaces:
  - 1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
  - 2. Wall surfaces directly external to raceways concealed within wall.
  - 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- N. Workspace Indication: Apply floor marking tape to finished surfaces. Show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- O. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.
- P. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
  - 1. Apply to exterior of door, cover, or other access.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- Q. Arc Flash Warning Labeling: Self-adhesive labels.
- R. Operating Instruction Signs: Baked-enamel warning signs
- S. Emergency Operating Instruction Signs: Baked-enamel warning signs with white legend on a red background with minimum 3/8-inch-high letters for emergency instructions at equipment used for power transfer.
- T. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets and racks of

each systems. Systems include power, lighting, control communications, signal, monitoring and alarm systems unless equipment is provided with its own identification.

1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
2. Outdoor Equipment: Laminated acrylic or melamine plastic sign.
3. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
4. Equipment to Be Labeled:
  - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.
  - b. Enclosures and electrical cabinets.
  - c. Access doors and panels for concealed electrical items.
  - d. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - e. Emergency system boxes and enclosures.
  - f. Motor-control centers.
  - g. Enclosed switches.
  - h. Enclosed circuit breakers.
  - i. Enclosed controllers.
  - j. Manual motor controllers.
  - k. Magnetic motor controllers.
  - l. Soft-start motor controllers.
  - m. Variable-speed controllers.
  - n. Push-button stations.
  - o. Power-transfer equipment.
  - p. Contactors.
  - q. Remote-controlled switches, dimmer modules, and control devices.
  - r. Battery-inverter units.
  - s. Battery racks.
  - t. Power-generating units.
  - u. Monitoring and control equipment.
  - v. UPS equipment.

**END OF SECTION**

## **SECTION 16231**

### **PACKAGED GENERATOR**

#### **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 packaged engine-generator sets for standby power supply with the following features:
  - 1. Diesel engine.
  - 2. Diesel fuel-oil system.
  - 3. Control and monitoring.
  - 4. Generator overcurrent and fault protection.
  - 5. Generator, exciter, and voltage regulator.
  - 6. Load banks.
  - 7. Outdoor engine generator enclosure.
  - 8. Remote radiator motors.
  - 9. Vibration isolation devices.
  - 10. Finishes.
- B. Related Sections include the following:
  - 1. Division 16 Section "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.
  - 2. Division 3 Section "Cast in Place Concrete".

##### **1.3 DEFINITIONS**

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Include thermal damage curve for generator.
  - 3. Include time-current characteristic curves for generator protective device.
  - 4. Include fuel consumption in gallons per hour at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.

5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
  6. Include airflow requirements for cooling and combustion air in cubic feet per minute at 0.8 power factor, with air-supply temperature of 95, 80, 70, and 50 deg F. Provide Drawings indicating requirements and limitations for location of air intake and exhausts.
  7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.
- B. Shop Drawings:
1. Include plans and elevations for engine generator and other components specified. Indicate access requirements affected by height of subbase fuel tank.
  2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Identify fluid drain ports and clearance requirements for proper fluid drain.
  4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
  6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for engine generators and functional relationship between all electrical components.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Seismic Qualification Data: Certificates, for engine generator, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: With engine and generator mounted on rails, identify center of gravity and total weight, including full fuel tank, supplied enclosure, external silencer, subbase-mounted fuel tank, and each piece of equipment not integral to the engine generator, and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Source Quality-Control Reports: Including, but not limited to, the following:
1. Certified summary of prototype-unit test report.
  2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
  3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
  4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
  5. Report of sound generation.

- 6. Report of exhaust emissions showing compliance with applicable regulations.
- D. Field quality-control reports.
- E. Warranty: For special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in "Operation and Maintenance Data," include the following:
    - a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
    - b. Operating instructions laminated and mounted adjacent to generator location.
    - c. Training plan.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
  - 2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
  - 3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
  - 4. Tools: Each tool listed by part number in operations and maintenance manual.

#### 1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

#### 1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.



## **PART 2 - PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Caterpillar, Inc.; Electric Power Division.
  - 2. Cummins Power Generation.
  - 3. Generac Power Systems, Inc.
  - 4. Kohler Power Systems.
  - 5. MTU America Inc.
- B. Source Limitations: Obtain packaged engine generators and auxiliary components from single source from single manufacturer.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Engine generator housing, subbase fuel tank, day tank, engine generator, batteries, battery racks, silencers, load banks, sound attenuating equipment, accessories, and components shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
  - 2. Shake-table testing shall comply with ICC-ES AC156. Testing shall be performed with all fluids at worst-case normal levels.
  - 3. Component Importance Factor: 1.0.
- B. B11 Compliance: Comply with B11.19.
- C. NFPA Compliance:
  - 1. Comply with NFPA 37.
  - 2. Comply with NFPA 70.
- D. UL Compliance: Comply with UL 2200.
- E. Engine Exhaust Emissions: Comply with applicable EPA emissions requirements for EPA New Source Performance Standards for stationary emergency engines and applicable state and local government standards.
- F. Engine Exhaust Emissions: Comply with EPA Tier 4 requirements and applicable state and local government requirements.
- G. Noise Emission: Comply with applicable state and local government requirements for maximum noise level at adjacent property boundaries due to sound emitted by engine generator including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation. Maximum noise level shall be 75dB measured at 23 feet from enclosure, or local requirements, whichever is more stringent.

- H. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
  - 1. Ambient Temperature: -10 to 115 deg F.
  - 2. Relative Humidity: Zero to 95 percent.
  - 3. Altitude: Sea level to 1000 feet.

## 2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

- A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.
- D. Governor: Adjustable isochronous, with speed sensing.
- E. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
  - 1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and engine generator center of gravity.
- F. Capacities and Characteristics:
  - 1. Power Output Ratings: Nominal ratings as indicated excluding power required for the continued and repeated operation of the unit and auxiliaries, with capacity as required to operate as a unit as evidenced by records of prototype testing.
  - 2. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- G. Engine Generator Performance:
  - 1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
  - 2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
  - 3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
  - 4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  - 5. Transient Frequency Performance: Less than 5 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
  - 6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics.

- Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
  7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
  8. Start Time: Comply with NFPA 110, Type 10, system requirements.
- H. Engine Generator Performance for Sensitive Loads:
1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
    - a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
  2. Steady-State Voltage Operational Bandwidth: 1 percent of rated output voltage from no load to full load.
  3. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 0.5 second.
  4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
  5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
  6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
  7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
  8. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
  9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
    - a. Provide permanent magnet excitation for power source to voltage regulator.
  10. Start Time: Comply with NFPA 110, Type 10, system requirements.
- I. Parallel Engine Generators:
1. Automatic reactive output power control and load sharing between engine generators operated in parallel.
  2. Automatic regulation, automatic connection to a common bus, and automatic synchronization, with manual controls and instruments to monitor and control paralleling functions.
  3. Protective relays required for equipment and personnel safety.
  4. Paralleling suppressors to protect excitation systems.
  5. Reverse power protection.
  6. Loss of field protection.

## 2.4 DIESEL ENGINE

- A. Fuel: ASTM D975, diesel fuel oil, Grade 2-D S15.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: Engine or skid-mounted.
  - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
  - 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
  - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499.
- E. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator set mounting frame and integral engine-driven coolant pump.
  - 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
  - 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
  - 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
  - 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
  - 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, UV-, and abrasion-resistant fabric.
    - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
    - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.
- F. Muffler/Silencer: Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
  - 1. Minimum sound attenuation of 25 dB at 500 Hz.
  - 2. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall meet the requirements of Paragraph 2.2.F of this section.
- G. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- H. Starting System: 12 or 24-V electric, with negative ground.

1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: 60 seconds.
4. Battery: Adequate capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing, and float-charging type. Unit shall comply with UL 1236 and include the following features:
  - a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
  - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 to 140 deg F prevent overcharging at high temperatures and undercharging at low temperatures.
  - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
  - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
  - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

## 2.5 DIESEL FUEL-OIL SYSTEM

- A. Comply with NFPA 30.

- B. Piping: Fuel-oil piping shall be Schedule 40 black steel, complying with requirements in "Facility Fuel-Oil Piping" section. Cast iron, aluminum, copper, and galvanized steel shall not be used in the fuel-oil system.
- C. Main Fuel Pump: Mounted on engine to provide primary fuel flow under starting and load conditions.
- D. Fuel Filtering: Remove water and contaminants larger than 1 micron.
- E. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- F. Fuel-Oil Storage Tank: Comply with requirements in "Facility Aboveground Fuel-Oil Storage Tanks" section.
- G. Fuel Tank Capacity: As recommended by engine manufacturer for an uninterrupted period of 24 hours' operation at 100 percent of rated power output of engine generator system without being refilled.
- H. Duplex Fuel-Oil Transfer Pump: Comply with requirements in "Facility Fuel-Oil Pumps" section.
- I. Subbase-Mounted, Double-Wall, Fuel-Oil Tank: Factory installed and piped, complying with UL 142 fuel-oil tank. Features include the following:
  - 1. Tank level indicator.
  - 2. Fuel-Tank Capacity: Minimum 133 percent of total fuel required for planned operation plus fuel for periodic maintenance operations between fuel refills.
  - 3. Leak detection in interstitial space.
  - 4. Vandal-resistant fill cap.
  - 5. Containment Provisions: Comply with requirements of authorities having jurisdiction.

## 2.6 CONTROL AND MONITORING

- A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.
- B. Manual Starting System Sequence of Operation: Switching on-off switch on the generator control panel to the on position starts engine generator. The off position of same switch initiates engine generator shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

- C. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.
- D. Comply with UL 508A.
- E. Configuration: Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from engine generator vibration. Panel shall be powered from the engine generator battery.
- F. Control and Monitoring Panel:
  - 1. Digital engine generator controller with integrated LCD display, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
  - 2. Instruments: Located on the control and monitoring panel and viewable during operation.
    - a. Engine lubricating-oil pressure gage.
    - b. Engine-coolant temperature gage.
    - c. DC voltmeter (alternator battery charging).
    - d. Running-time meter.
    - e. AC voltmeter, for each phase.
    - f. AC ammeter, for each phase.
    - g. AC frequency meter.
    - h. Generator-voltage adjusting rheostat.
  - 3. Controls and Protective Devices: Controls, shutdown devices, and common alarm indication, including the following:
    - a. Cranking control equipment.
    - b. Run-Off-Auto switch.
    - c. Control switch not in automatic position alarm.
    - d. Overcrank alarm.
    - e. Overcrank shutdown device.
    - f. Low-water temperature alarm.
    - g. High engine temperature pre-alarm.
    - h. High engine temperature.
    - i. High engine temperature shutdown device.
    - j. Overspeed alarm.
    - k. Overspeed shutdown device.
    - l. Low fuel main tank. Low fuel alarm shall alarm when available fuel is less than that required for 4 hours of continuous operation at rated load.
    - m. Coolant low-level alarm.
    - n. Coolant low-level shutdown device.
    - o. Coolant high-temperature prealarm.
    - p. Coolant high-temperature alarm.
    - q. Coolant low-temperature alarm.
    - r. Coolant high-temperature shutdown device.
    - s. Battery high-voltage alarm.
    - t. Low cranking voltage alarm.
    - u. Battery-charger malfunction alarm.
    - v. Battery low-voltage alarm.
    - w. Lamp test.

- x. Contacts for local and remote common alarm.
  - y. Low-starting air pressure alarm.
  - z. Low-starting hydraulic pressure alarm.
  - aa. Remote manual stop shutdown device.
  - bb. Air shutdown damper alarm when used.
  - cc. Air shutdown damper shutdown device when used.
  - dd. Generator overcurrent-protective-device not-closed alarm.
  - ee. Hours of operation.
  - ff. Engine generator metering, including voltage, current, hertz, kilowatt, kilovolt ampere, and power factor.
- G. Connection to Datalink:
- 1. A separate terminal block, factory wired to Form C dry contacts, for each alarm and status indication.
  - 2. Provide connections for datalink transmission of indications to remote data terminals via ModBus or Ethernet.
- H. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator unless otherwise indicated.

## 2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. Overcurrent protective devices shall be coordinated to optimize selective tripping when a short circuit occurs.
- B. Generator Circuit Breaker: Molded-case, electronic-trip type; 100 percent rated; complying with UL 489.
- 1. Tripping Characteristics: Adjustable long-time and short-time delay and instantaneous.
  - 2. Trip Settings: Selected to coordinate with generator thermal damage curve.
  - 3. Shunt Trip: Connected to trip breaker when engine generator is shut down by other protective devices.
  - 4. Mounting: Adjacent to, or integrated with, control and monitoring panel.
- C. Generator Protector: Microprocessor-based unit shall continuously monitor current level in each phase of generator output, integrate generator heating effect over time, and predict when thermal damage of alternator will occur. When signaled by generator protector or other engine generator protective devices, a shunt-trip device in the generator disconnect switch shall open the switch to disconnect the generator from load circuits. Protector performs the following functions:
- 1. Initiates a generator overload alarm when generator has operated at an overload equivalent to 110 percent of full-rated load for 60 seconds. Indication for this alarm is integrated with other engine generator malfunction alarms. Contacts shall be available for load shed functions.
  - 2. Under single- or three-phase fault conditions, regulates generator to 300 percent of rated full-load current for up to 10 seconds.



3. As overcurrent heating effect on the generator approaches the thermal damage point of the unit, protector switches the excitation system off, opens the generator disconnect device, and shuts down the engine generator.
4. Senses clearing of a fault by other overcurrent devices and controls recovery of rated voltage to avoid overshoot.

## 2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Dripproof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
  1. Adjusting Rheostat on Control and Monitoring Panel: Provide plus or minus 5 percent adjustment of output-voltage operating band.
  2. Maintain voltage within 15 percent on one step, full load.
  3. Provide anti-hunt provision to stabilize voltage.
  4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.
- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 12 percent, maximum.

## 2.9 OUTDOOR ENGINE GENERATOR ENCLOSURE

- A. Description: Vandal-resistant, sound-attenuating, weatherproof steel housing; wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.

- B. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 100 mph.
- C. Seismic Design: Comply with seismic requirements in Section 16148 "Seismic Controls for Electrical Systems."
- D. Hinged Doors: With padlocking provisions.
- E. Space Heater: Thermostatically controlled and sized to prevent condensation.
- F. Thermal Insulation: Manufacturer's standard materials and thickness selected in coordination with space heater to maintain winter interior temperature within operating limits required by engine generator components.
- G. Muffler Location: As recommended by manufacturer.
- H. Engine-Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for two hours with ambient temperature at top of range specified in system service conditions.
  - 1. Louvers: Fixed-engine, cooling-air inlet and discharge. Stormproof and drainable louvers prevent entry of rain and snow.
  - 2. Automatic Dampers: At engine cooling-air inlet and discharge. Dampers shall be closed to reduce enclosure heat loss in cold weather when unit is not operating.
- I. Convenience Outlets: Factory-wired, GFCI. Arrange for external electrical connection.

## 2.10 VIBRATION ISOLATION DEVICES

- A. Vibration Isolation Devices: As recommended by the manufacturer and approved via seismic qualification submittal data to meet project requirements. Vibration isolation devices may be one of the following types:
  - 1. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized-steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
    - a. Material: Standard neoprene separated by steel shims or as recommended by the manufacturer.
  - 2. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
    - a. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment-mounting and -leveling bolt that acts as blocking during installation.
    - b. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
    - c. Minimum Additional Travel: 50 percent of required deflection at rated load.
    - d. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

- e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
  - f. Minimum Deflection: 1 inch.
- B. Comply with requirements in "Hydronic Piping Specialties" section for vibration isolation and flexible connector materials for steel piping.
- C. Comply with requirements in "Metal Ducts" section for vibration isolation and flexible connector materials for exhaust shroud and ductwork.
- D. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

## 2.11 FINISHES

- A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

## 2.12 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine generator using same engine model, constructed of identical or equivalent components, and equipped with identical or equivalent accessories.
  - 1. Tests: Comply with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine generator and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
  - 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
  - 2. Test generator, exciter, and voltage regulator as a unit.
  - 3. Full load run.
  - 4. Maximum power.
  - 5. Voltage regulation.
  - 6. Transient and steady-state governing.
  - 7. Single-step load pickup.
  - 8. Safety shutdown.
  - 9. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
  - 10. Report factory test results within 10 days of completion of test.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

- B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 404.
- B. Comply with packaged engine generator manufacturers' written installation and alignment instructions.
- C. Equipment Mounting:
  - 1. Install packaged engine generators on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in "Cast-in-Place Concrete" section.
  - 2. Coordinate size and location of concrete bases for packaged engine generators and remote radiators mounted on grade. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
  - 3. Install packaged engine generator with vibration isolation devices having a minimum deflection of 1 inch on 4-inch-high concrete base. Secure engine generator to anchor bolts installed in concrete bases. Concrete base construction is specified in Section 16148 "Seismic Controls for Electrical Systems."
- D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- E. If engine generator is under building cover or inside:
  - 1. Exhaust System: Install Schedule 40 black steel piping with welded joints and connect to engine muffler. Install thimble at wall/ceiling/roof as indicated. Piping shall be same diameter as muffler outlet.
    - a. Piping materials and installation requirements are specified in "Hydronic Piping" section.
    - b. Install flexible connectors and steel piping materials according to requirements in "Hydronic Piping Specialties" section
    - c. Insulate muffler/silencer and exhaust system components according to requirements in "HVAC Piping Insulation" section
  - 2. Install isolating thimbles where exhaust piping penetrates combustible surfaces with a minimum of 9 inches of clearance from combustibles.
- F. Drain Piping: Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40 black steel pipe with welded joints.
  - 1. Piping materials and installation requirements are specified in "Hydronic Piping" section.
  - 2. Drain piping valves, connectors, and installation requirements are specified in "Hydronic Piping Specialties" section
- G. Fuel Piping:

1. Diesel storage tanks, tank accessories, piping, valves, and specialties for fuel systems are specified in "Facility Fuel-Oil Piping" section.
  2. Copper and galvanized steel shall not be used in the fuel-oil piping system.
- H. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

### 3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow space for service and maintenance.
- C. Connect cooling-system water piping to engine generator set with flexible connectors.
- D. Connect engine exhaust pipe to engine with flexible connector.
- E. Connect fuel piping to engines with a gate valve and union and flexible connector.
- F. Ground equipment according to Section 16126 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 16119 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.
- H. Balance single-phase loads to obtain a maximum of 10 percent unbalance between any two phases.

### 3.4 IDENTIFICATION

- A. Identify system components according to Section 16153 "Identification for Electrical Systems."
- B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Tests and Inspections:

1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in first two subparagraphs below, as specified in NETA ATS. Certify compliance with test parameters.
  - a. Visual and Mechanical Inspection:
    - 1) Compare equipment nameplate data with Drawings and the Specifications.
    - 2) Inspect physical and mechanical condition.
    - 3) Inspect anchorage, alignment, and grounding.
    - 4) Verify that the unit is clean.
  - b. Electrical and Mechanical Tests:
    - 1) Perform insulation-resistance tests according to IEEE 43.
      - a) Machines Larger Than 150 kW: Test duration shall be 10 minutes. Calculate polarization index.
      - b) Machines 150 kW or Less: Test duration shall be one minute. Calculate the dielectric-absorption ratio.
    - 2) Test protective relay devices.
    - 3) Verify phase rotation, phasing, and synchronized operation as required by the application.
    - 4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.
    - 5) Perform vibration test for each main bearing cap.
    - 6) Verify correct functioning of the governor and regulator.
2. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
  - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
  - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
  - c. Verify acceptance of charge for each element of the battery after discharge.
  - d. Verify that measurements are within manufacturer's specifications.
3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.
5. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
6. Exhaust Emissions Test: Comply with applicable government test criteria.
7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases, and verify that performance is as specified.

8. Harmonic-Content Tests: Measure harmonic content of output voltage at 25 and 100 percent of rated linear load. Verify that harmonic content is within specified limits.
  9. Noise Level Tests: Measure A-weighted level of noise emanating from engine generator installation, including engine exhaust and cooling-air intake and discharge, at four locations on the property line, and compare measured levels with required values.
- E. Coordinate tests with tests for transfer switches and run them concurrently.
  - F. Test instruments shall have been calibrated within the past 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.
  - G. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.
  - H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.
  - I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - J. Remove and replace malfunctioning units and retest as specified above.
  - K. Retest: Correct deficiencies identified by tests and observations, and retest until specified requirements are met.
  - L. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
  - M. Infrared Scanning: After Substantial Completion, but not more than 60 days after final acceptance, perform an infrared scan of each power wiring termination and each bus connection while running with maximum load. Remove all access panels so terminations and connections are accessible to portable scanner.
    1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
    2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's authorized service representative. Include quarterly preventive maintenance and exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Parts shall be manufacturer's authorized replacement parts and supplies.

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

### 3.8 FUEL SUPPLY

- A. Contractor shall supply all fuel required for testing and use during construction. Contractor shall completely refill the fuel system at substantial completion.
- B. Contractor shall pay the costs of all fuel used for testing and use during construction.

**END OF SECTION**



## **SECTION 16416**

### **PANELBOARDS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Section 16483 "Surge Protection for Low-Voltage Electrical Power Circuits"

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.
  - 3. Load centers.
  - 4. Electronic-grade panelboards.

##### **1.3 DEFINITIONS**

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.

2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
4. Detail bus configuration, current, and voltage ratings.
5. Short-circuit current rating of panelboards and overcurrent protective devices.
6. Include evidence of NRTL listing for series rating of installed devices.
7. Include evidence of NRTL listing for SPD as installed in panelboard for factory-mounted SPDs.
8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
9. Include wiring diagrams for power, signal, and control wiring.
10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit in PDF format; include selectable ranges for each type of overcurrent protective device.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01730 "Installation, Operation, and Maintenance Manuals," include the following:
  1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Keys: Two spares for each type of panelboard cabinet lock.
  2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
  3. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

## 1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.
- B. Obtain panelboards, overcurrent protective devices, components and accessories from single source from single manufacturer.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. Handle and prepare panelboards for installation according to NEMA PB 1.

## 1.10 FIELD CONDITIONS

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
    - b. Altitude: Not exceeding 3300 feet.

## 1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  - 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 16148 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures:
  - 1. Standalone Units: Flush and Surface-mounted, dead-front cabinets.
  - 2. MCC Units: Reference specification Section "16419" for enclosure requirements of panelboard units installed in MCCs.
  - 3. Rated for environmental conditions at installed location.
    - a. General Purpose Areas: NEMA 250, Type 1.
    - b. Indoor Wet and/or Damp Areas: NEMA 250, Type 12/3R.
    - c. Outdoor Areas: NEMA 250, Type 12/3R.
    - d. Wash-Down Areas: NEMA 250, Type 4X, stainless steel.
    - e. Corrosive Areas: NEMA 250, Type 4X, stainless steel.
    - f. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 4.
  - 4. Height: 84 inches maximum.
  - 5. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
  - 6. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
  - 7. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
  - 8. Finishes:
    - a. Panels and Trim: Galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
    - b. Back Boxes: Same finish as panels and trim.
    - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
- G. Incoming Mains:
  - 1. Location: Top and bottom.
  - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- H. Phase, Neutral, and Ground Buses:
  - 1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
  6. Extra-Capacity Neutral Bus (where indicated on the drawings): Neutral bus rated 200 percent of phase bus and listed and labeled by an NRTL acceptable to authority having jurisdiction, as suitable for nonlinear loads. Connectors shall be sized for double-sized or parallel conductors as indicated on Drawings. Do not mount neutral bus in gutter.
  7. Split Bus: Vertical buses divided into individual vertical sections.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity.
  2. Terminations shall allow use of 75 deg C rated conductors without derating.
  3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
  6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
  7. Sub-feed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
  8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.
  9. Extra-Capacity Neutral Lugs: Rated 200 percent of phase lugs mounted on extra-capacity neutral bus.
- J. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices.
- K. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 5 percent.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
  2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
- B. Surge Suppression: Factory installed as an integral part or nipple-mounted and complying with Section 16483 "Surge Protection for Low-Voltage Electrical Power Circuits".

## 2.3 PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Eaton.
  - 2. General Electric Company; GE Energy Management - Electrical Distribution.
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
  - 1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker or lugs only as indicated.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

## 2.4 LOAD CENTERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Eaton.
  - 2. General Electric Company; GE Energy Management - Electrical Distribution.
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. Square D; by Schneider Electric.
- B. Load Centers: Comply with UL 67.
- C. Mains: Circuit breaker or lugs only as indicated.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges secured with flush latch with tumbler lock; keyed alike.

- F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton.
  2. General Electric Company; GE Energy Management - Electrical Distribution.
  3. Siemens Industry, Inc., Energy Management Division.
  4. Square D; by Schneider Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  3. Electronic Trip Circuit Breakers:
    - a. RMS sensing.
    - b. Field-replaceable rating plug or electronic trip.
    - c. Digital display of settings, trip targets, and indicated metering displays.
    - d. Multi-button keypad to access programmable functions and monitored data.
    - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    - f. Integral test jack for connection to portable test set or laptop computer.
    - g. Field-Adjustable Settings:
      - 1) Instantaneous trip.
      - 2) Long- and short-time pickup levels.
      - 3) Long- and short-time adjustments.
      - 4) Ground-fault pickup level, time delay, and I squared T response.
  4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  7. Arc-Fault Circuit Interrupter Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
  8. Sub-feed Circuit Breakers: Vertically mounted.
  9. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Where indicated on the drawings:

- 1) Ground-Fault Protection: Integrally mounted or remote-mounted as required, relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
- 2) Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 75 percent of rated voltage.
- 3) Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
- 4) Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
- 5) Auxiliary Contacts: One, SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts and "b" contacts operate in reverse of circuit-breaker contacts.
- 6) Alarm Switch: Single-pole, normally open contact that actuates only when circuit breaker trips.
- 7) Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
- 8) Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function with other upstream or downstream devices.
- 9) Multipole units enclosed in a single housing with a single handle.
- 10) Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- 11) Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## 2.6 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## 2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.



- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install panelboards and accessories according to NEMA PB 1.1.
- C. Equipment Mounting:
  - 1. Install floor-mounted panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03300 "Cast-in-Place Concrete."
    - a. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
    - b. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
    - c. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions and directions furnished with items to be embedded.
    - d. Install anchor bolts to elevations required for proper attachment to panelboards.
    - e. Attach panelboard to the vertical finished or structural service behind the panelboard.

2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
  3. Comply with requirements for seismic control devices specified in Section 16148 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- E. Comply with mounting and anchoring requirements specified in Section 16148 "Seismic Controls for Electrical Systems."
- F. Mount panelboards and load centers so that the operating handle of the highest overcurrent protection device is no higher than 6'7" above finished floor unless provided with provisions for operating from the floor.
1. Care shall be taken to ensure that panelboards and load centers are mounted at heights convenient for Operator's use. Panelboards and load centers shall not be mounted with the bottom of the trim below 3' above finished floor unless doing so would place the operating handle of the highest overcurrent protection device above 6'7" above finished floor.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- I. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
- J. Install overcurrent protective devices and controllers not already factory installed.
1. Set field-adjustable, circuit-breaker trip ranges.
  2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- L. Install filler plates in unused spaces.
- M. For flush-mounted panelboards, stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.
- N. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 16153 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 16153 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 16153 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 16153 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in section 16670 "Electrical Testing."

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 16675 "Coordination Studies."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
  - 1. Measure loads during period of normal facility operations.
  - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Engineer. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
  - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
  - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not exceed 20 percent.

### 3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

**END OF SECTION**

## **SECTION 16426**

### **WIRING DEVICES**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Standard-grade receptacles.
  - 2. USB receptacles.
  - 3. GFCI receptacles.
  - 4. SPD receptacles.
  - 5. Hazardous (classified) location receptacles.
  - 6. Twist-locking receptacles.
  - 7. Pendant cord-connector devices.
  - 8. Cord and plug sets.
  - 9. Toggle switches.
  - 10. Occupancy sensors.
  - 11. Digital timer light switches.
  - 12. Residential devices.
  - 13. Wall-box dimmers.
  - 14. Wall plates.

##### **1.3 DEFINITIONS**

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Service/Power Poles: One for every 10, but no fewer than one.
  - 2. Floor Service-Outlet Assemblies: One for every 10, but no fewer than one.
  - 3. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.
  - 4. SPD Receptacles: One for every 10 of each type installed, but no fewer than two of each type.

### PART 2 - PRODUCTS

#### 2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:
  - 1. Connectors shall comply with UL 2459 and shall be made with stranding building wire.
  - 2. Devices shall comply with requirements in this Section.
- F. Devices for Owner-Furnished Equipment:
  - 1. Receptacles: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.
- G. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Essential Electrical System: Red.

3. SPD Devices: Blue.
  4. Isolated-Ground Receptacles: Orange.
- H. Wall Plate Color: For plastic covers, match device color.
- I. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

## 2.2 STANDARD-GRADE RECEPTACLES

- A. Duplex Receptacles, 125 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Eaton (Arrow Hart).
    - b. Hubbell Incorporated (Commercial and Industrial Group - Wiring Device-Kellems).
    - c. Leviton Manufacturing Co., Inc.
    - d. Pass & Seymour/Legrand (Pass & Seymour).
  2. Description: Two pole, three wire, and self-grounding.
  3. Configuration: NEMA WD 6, Configuration 5-20R.
  4. Standards: Comply with UL 498 and FS W-C-596.
- B. Isolated-Ground Duplex Receptacles, 125 V, 20 A:
1. Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498 and FS W-C-596.
- C. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498 and FS W-C-596.
  4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" Article.
- D. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Standards: Comply with UL 498.
  4. Marking: Listed and labeled as complying with NFPA 70, "Receptacles in Damp or Wet Locations" Article.
- E. Tamper- and Weather-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
2. Configuration: NEMA WD 6, Configuration 5-20R.
3. Standards: Comply with UL 498.
4. Marking: Listed and labeled as complying with NFPA 70, "Tamper-Resistant Receptacles" and "Receptacles in Damp or Wet Locations" articles.

## 2.3 GFCI RECEPTACLES, 125 V, 20 A

- A. Duplex GFCI Receptacles, 125 V, 20 A:
  1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
  2. Configuration: NEMA WD 6, Configuration 5-20R.
  3. Type: Feed through.
  4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

## 2.4 HAZARDOUS (CLASSIFIED) LOCATION RECEPTACLES

- A. Hazardous (Classified) Locations Receptacles:
  1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Cooper Crouse-Hinds.
    - b. EGS/Appleton Electric.
    - c. Hubbell Incorporated (Construction and Energy Group).
  2. Description: Hazardous location receptacles shall be simplex delayed action circuit breaking type with spring door. Receptacles shall be rated at 125V, 20A, NEMA 5-20R.
    - a. Furnish one matching 20A hazardous location plug to the Owner for each receptacle, NEMA 5-20P.
  3. All hazardous location receptacles shall be rated for the environment in which they are installed. Reference hazardous area classification plan on the drawings for additional information.
  4. Standards: Comply with NEMA FB 11 and UL 1203.

## 2.5 MELTRIC RECEPTACLES

- A. Description: Outdoor rated special purpose receptacles with integral load breaking mechanism to ensure load is broken before the plug is removed from the receptacle.
- B. General Requirements:
  1. Each receptacle shall be furnished with a matching plug and receptacle with voltage rating, amperage rating and pole configuration as indicated on the drawings.
  2. Constant pressure butt-contacts. Pin and sleeve contacts are not permitted.
  3. Receptacles must have keyed system to discriminate between circuits or incompatible operating voltages or frequencies.
  4. UV Resistant.
- C. General Purpose:



1. Plug and receptacle terminals must be spring assisted to prevent loosening due to conductor yielding, shocks, vibrations or thermal cycling.
  2. NEMA 3R minimum environmental protection rating.
  3. Meltric DR Series or approved equal.
- D. Hazardous Location:
1. Receptacle shall be listed for Class 1, Division 2, Groups A, B, C and D.
  2. Receptacles shall be able to safely connect and disconnect equipment under full load in potentially hazardous and explosive environments.
  3. IP 66+67 minimum environmental protection rating.
  4. Meltric DSN/DS Series or approved equal.
- E. Accessories:
1. Handles: Poly with cord grip and strain relief mesh, size as required.
  2. Wall Box:
    - a. General Purpose: 70-degree poly angle with aluminum box and NPT.
    - b. Hazardous Location: 30-degree metal angle with metal box and NPT.
  3. Pawl: Padlock pawl unless otherwise indicated.

## 2.6 TWIST-LOCKING RECEPTACLES

- A. Twist-Lock, Single Receptacles, 120 V, 20 A:
1. Configuration: NEMA WD 6, Configuration L5-20R.
  2. Standards: Comply with UL 498.
- B. Twist-Lock, Single Receptacles, 250 V, 20 A:
1. Configuration: NEMA WD 6, Configuration L6-20R.
  2. Standards: Comply with UL 498.
  3. Twist-Lock, Single Receptacles, 277 V, 20 A:
  4. Configuration: NEMA WD 6, Configuration L7-20R.
  5. Standards: Comply with UL 498.
- C. Twist-Lock, Isolated-Ground, Single Receptacles, 125 V, 20 A:
1. Grounding: Equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.
  2. Configuration: NEMA WD 6, Configuration L5-20R.
  3. Standards: Comply with UL 498.

## 2.7 PENDANT CORD-CONNECTOR DEVICES

- A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.
- B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.
- C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.

- D. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.
- E. Standards: Comply with FS W-C-596.

## 2.8 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.9 TOGGLE SWITCHES, 120/277 V, 20 A

- A. Single-Pole Switches, 120/277 V, 20 A:
  - 1. Standards: Comply with UL 20 and FS W-S-896.
- B. Two-Pole Switches, 120/277 V, 20 A:
  - 1. Comply with UL 20 and FS W-S-896.
- C. Three-Way Switches, 120/277 V, 20 A:
  - 1. Comply with UL 20 and FS W-S-896.
- D. Four-Way Switches, 120/277 V, 20 A:
  - 1. Standards: Comply with UL 20 and FS W-S-896.
- E. Pilot-Light, Single-Pole Switches: 120/277 V, 20 A:
  - 1. Description: Illuminated when switch is on.
  - 2. Standards: Comply with UL 20 and FS W-S-896.
- F. Lighted Single-Pole Switches, 120/277 V, 20 A:
  - 1. Description: Handle illuminated when switch is off.
  - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- G. Key-Operated, Single-Pole Switches, 120/277 V, 20 A:
  - 1. Description: Factory-supplied key in lieu of switch handle.
  - 2. Standards: Comply with UL 20 and FS W-S-896.
- H. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
  - 1. Description: For use with mechanically held lighting contactors.
  - 2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.
- I. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:

1. Description: For use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.
2. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

## 2.10 OCCUPANCY SENSORS

- A. Wall Switch Sensor Light Switch, Dual Technology:
1. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
  2. Standards: Comply with UL 20.
  3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
  4. Adjustable time delay of 30 minutes.
  5. Able to be locked to Automatic-On mode.
  6. Connections: Integral wireless networking.
- B. Wall Sensor Light Switch, Passive Infrared:
1. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
  2. Standards: Comply with UL 20.
  3. Connections: Wireless.
  4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
  5. Adjustable time delay of 30 minutes.
  6. Able to be locked to Automatic-On mode.
- C. Wall Sensor Light Switch, Ultrasonic:
1. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.
  2. Standards: Comply with UL 20.
  3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
  4. Adjustable time delay of 30 minutes.
  5. Able to be locked to Automatic-On mode.

## 2.11 TIMER LIGHT SWITCH

- A. Digital Timer Light Switch:
1. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10-minute increments.
  2. Standards: Comply with UL 20.
  3. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
  4. Integral relay for connection to BAS.

## 2.12 COMMUNICATIONS OUTLETS

- A. Telephone Outlet:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Eaton (Arrow Hart).
    - b. Leviton Manufacturing Co., Inc.
    - c. Hubbell.
  2. Description: Single RJ-11 jack for terminating Category 35e, balanced twisted pair cable complying with Section 16123 "Control-Voltage Electrical Power Cables."
  3. Standards: Comply with UL 1863.
- B. Combination Telephone and Coaxial Outlet:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
    - a. Eaton (Arrow Hart).
    - b. Leviton Manufacturing Co., Inc.
    - c. Hubbell.
  2. Description: Single RJ-11 jack for terminating Category 35e, twisted pair cable complying with Section 16123 "Control-Voltage Electrical Power Cables" and a single BNC connector for terminating coaxial cable.
  3. Standards: Comply with UL 1863.

## 2.13 DIMMERS

- A. Wall-Box Dimmers:
1. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
  2. Control: Continuously adjustable slider; with single-pole or three-way switching.
  3. Standards: Comply with UL 1472.
  4. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

## 2.14 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
  2. Material for Finished Spaces: 0.035-inch-thick, satin-finished, Type 302 stainless steel.
  3. Material for Unfinished Spaces: 0.035-inch thick, satin-finished, Type 302 stainless steel.
  4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable cover.

- D. Municipal and Industrial Equipment Area Cover Plates: 0.035-inch thick, satin-finished, Type 302 stainless steel.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise noted below:
  - 1. 24 inches above finished floor in municipal and industrial equipment areas.
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
  - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
  - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
  - 3. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.
  - 4. Existing Conductors:
    - a. Cut back and pigtail or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
  - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
  - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
  - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the left.
  2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan-speed control are listed for that application.
  3. Install unshared neutral conductors on line, and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.

### 3.2 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

### 3.3 IDENTIFICATION

- A. Comply with Section 16153 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### 3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing."

## END OF SECTION

## SECTION 16430

### ENCLOSED SWITCHES AND CIRCUIT BREAKERS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Fusible switches.
  - 2. Nonfusible switches.
  - 3. Receptacle switches.
  - 4. Shunt trip switches.
  - 5. Molded-case circuit breakers (MCCBs).
  - 6. Molded-case switches.
  - 7. Enclosures.

##### 1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
  - 1. Enclosure types and details for types other than NEMA 250, Type 1.
  - 2. Current and voltage ratings.
  - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  - 4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
  - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
  - 6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in PDF format.
- B. Shop Drawings: For enclosed switches and circuit breakers.
  - 1. Include plans, elevations, sections, details and attachments to other work.

2. Include wiring diagrams for power, signal and control wiring.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Data: Certificates, for enclosed switches and circuit breakers, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
  1. In addition to items specified in Section 01730 "Installation, Operation and Maintenance Manuals," include the following:
    - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
    - b. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device. Provide in digital format.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  2. Fuse Pullers: Two for each size and type.

## 1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

## 1.9 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
  2. Altitude: Not exceeding 3300 feet.



## 1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers and components with equipment served and adjacent surfaces. Maintain required workspace clearances for equipment access doors and panels.

## 1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year(s) from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

## 2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

## 2.3 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. ABB (Electrification Products Division).
  - 2. Eaton.
  - 3. Siemens Industry, Inc., Energy Management Division.
  - 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty:
  - 1. Single or Double throw as indicated on the drawings.
  - 2. Number of poles as indicated on the drawings.

3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
6. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contacts shall be rated for 120-V ac or as indicated on the drawings.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

## 2.4 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. ABB (Electrification Products Division).
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; by Schneider Electric.

B. Type HD, Heavy Duty:

1. Single or Double throw as indicated on the drawings.
2. Number of poles as indicated on the drawings.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated.
6. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.

C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.

4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contacts shall be rated for 120-V ac or as indicated on the drawings.
6. Hookstick Handle: Allows use of a hookstick to operate the handle.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

## 2.5 RECEPTACLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. ABB (Electrification Products Division).
  2. Eaton.
  3. Siemens Industry, Inc., Energy Management Division.
  4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty:
  1. Single or Double throw as indicated on the drawings.
  2. Number of poles as indicated on the drawings.
  3. 600-V ac.
  4. 100 A and smaller.
  5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses.
  6. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.
- C. Interlocking Linkage: Provided between the receptacle and switch mechanism to prevent inserting or removing plug while switch is in the on position, inserting any plug other than specified, and turning switch on if an incorrect plug is inserted or correct plug has not been fully inserted into the receptacle.
- D. Receptacle: Polarized, three-phase, four-wire receptacle (fourth wire connected to enclosure ground lug).
- E. Accessories:
  1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Isolated Ground Kit: Internally mounted; insulated, labeled for copper and aluminum neutral conductors.
  4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  5. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contacts shall be rated for 120-V ac or as indicated on the drawings.
  6. Hookstick Handle: Allows use of a hookstick to operate the handle.

7. Lugs: Mechanical type, suitable for number, size, and conductor material.
8. Service-Rated Switches: Labeled for use as service equipment.

## 2.6 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. ABB (Electrification Products Division).
  2. Eaton.
  3. Siemens Industry, Inc., Energy Management Division.
  4. Square D; by Schneider Electric.
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated for the available fault current unless otherwise indicated on the Drawings.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 194 deg F (90 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
- G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
  1. Instantaneous trip.
  2. Long- and short-time pickup levels.
  3. Long- and short-time time adjustments.

4. Ground-fault pickup level, time delay, and I-squared t response.
- K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- O. Features and Accessories:
  1. Standard frame sizes, trip ratings, and number of poles.
  2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
  7. Alarm Switch: One NO contact that operates only when circuit breaker has tripped.
  8. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
  9. Zone-Selective Interlocking: Integral with electronic trip unit; for interlocking ground-fault protection function.
  10. Electrical Operator: Provide remote control for on, off, and reset operations.
  11. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac.

## 2.7 MOLDED-CASE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. ABB (Electrification Products Division).
  2. Eaton.
  3. Siemens Industry, Inc., Energy Management Division.
  4. Square D; by Schneider Electric.
- B. Description: MCCB with fixed, high-set instantaneous trip only, and short-circuit withstand rating equal to equivalent breaker frame size interrupting rating.

- C. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- D. Features and Accessories:
  - 1. Standard frame sizes and number of poles.
  - 2. Lugs:
    - a. Mechanical type, suitable for number, size, trip ratings, and conductor material.
    - b. Lugs shall be suitable for 194 deg F (90 deg C) rated wire, sized according to the 167 deg F (75 deg C) temperature rating in NFPA 70.
  - 3. Ground-Fault Protection: Comply with UL 1053; remote-mounted and powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
  - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
  - 6. Auxiliary Contacts: One SPDT switch with "a" and "b" contacts; "a" contacts mimic switch contacts, "b" contacts operate in reverse of switch contacts.
  - 7. Alarm Switch: One NO contact that operates only when switch has tripped.
  - 8. Key Interlock Kit: Externally mounted to prohibit switch operation; key shall be removable only when switch is in off position.
  - 9. Zone-Selective Interlocking: Integral with ground-fault shunt trip unit; for interlocking ground-fault protection function.
  - 10. Electrical Operator: Provide remote control for on, off, and reset operations.
  - 11. Accessory Control Power Voltage: Integrally mounted, self-powered; 120-V ac.

## 2.8 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 12.
  - 2. Outdoor Locations: NEMA 250, Type 4X, Stainless Steel.
  - 3. Other Wet, Damp or Corrosive Locations: NEMA 250, Type 4X, Stainless Steel.
  - 4. Indoor Locations Subject to Dust, Falling Dirt and Dripping Noncorrosive Liquids: NEMA 250, Type 4.
  - 5. Hazardous Areas: NEMA 250, Type 7/9.
- B. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both end walls.
- C. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover. The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

- D. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- E. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
  - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

### **3.2 INSTALLATION**

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 16148 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

### **3.3 IDENTIFICATION**

- A. Comply with requirements in Section 16153 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

### 3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 16675 "Coordination Studies."

**END OF SECTION**



## **SECTION 16453**

### **VARIABLE-FREQUENCY MOTOR CONTROLLERS**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections:
  - 1. Section 16012 "Electrical General".
  - 2. Section 16153 "Identification for Electrical Systems".
  - 3. Section 16670 "Electrical Testing"

##### **1.2 SUMMARY**

- A. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.
  - 1. As a bid additive alternate, provide Motor Controller with integrated variable frequency controller and harmonic filter.

##### **1.3 DEFINITIONS**

- A. CE: Conformance Europeene (European Compliance).
- B. CPT: Control power transformer.
- C. CSI: Control System Integrator.
- D. DDC: Direct digital control.
- E. EMI: Electromagnetic interference.
- F. IGBT: Insulated-gate bipolar transistor
- G. LAN: Local area network.
- H. LED: Light-emitting diode.
- I. MCC: Motor-control center.
- J. MCCB: Molded-case circuit breaker.
- K. MCP: Motor-circuit protector.
- L. NC: Normally closed.

- M. NO: Normally open.
- N. OCPD: Overcurrent protective device.
- O. PID: Control action, proportional plus integral plus derivative.
- P. PWM: Pulse-width modulated.
- Q. RFI: Radio-frequency interference.
- R. SPD: Surge protective device.
- S. VFC: Variable-frequency motor controller.

#### 1.4 ACTION SUBMITTALS

- A. In accordance with the submittal requirements of Section 16012, the Electrical Contractor shall work with the motor control manufacturer to develop and submit to the Engineer, through the Contractor, the following project data:
  - 1. Itemized list of all motor control features and components.
  - 2. System wiring diagrams for each unit of motor control equipment including, but not limited to: all instruments, relays, starters, switches, lights, breakers, terminals, etc. Indicate on submitted diagrams the terminals for remote devices as shown on the wiring diagrams in the contract drawings. Wire and terminal numbers shall be included on the schematic diagrams. Relay contacts shall be indicated for type and number available for each relay used.
  - 3. Information on ratings and sizes of all equipment such as control transformers, fuses, breakers, etc. on the wiring diagrams for each unit.
  - 4. Shop Drawings shall be provided on 11 by 17 inch sheets maximum size and shall be scaled using standard engineering or architectural scales.
  - 5. Connection diagrams showing physical wiring layout for each unit.
  - 6. Technical data sheets for all components with the complete part number of the component clearly designated with all required options as specified in PART 2. Provide at a minimum one tab section for each product listed in PART 2 of this section.
  - 7. Scaled elevation drawings of the motor control equipment exterior and interior with all devices clearly labeled.
  - 8. Scaled arrangement drawings of all panel front- and internal-mounted instruments, switches, devices and equipment indicated. Show all mounting details required. Deviations from approved arrangements require resubmittal and approval prior to installation.
  - 9. Bill of materials showing quality, manufacturer, catalog number and the supplier name and phone number for all components of the motor control.
- B. Product Data: For each type and rating of VFC indicated.
  - 1. Include dimensions and finishes for VFCs.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- C. Shop Drawings: For each VFC indicated.

1. For motor controllers installed in MCC compartments, reference specification Section 16419 “Motor-Control Centers”.
2. For each VFC indicated:
  - a. Include plans, elevations, sections, and mounting details.
  - b. Indicate dimensions, weights, required clearances, and location and size of each field connection.
  - c. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
  - d. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
  - e. Comply with other “Shop Drawing” requirements of Section 16928.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Required working clearances and required area above and around VFCs.
  2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.
  3. Show support locations, type of support, and weight on each support.
  4. Indicate field measurements.
- B. Qualification Data: For testing agency.
- C. Seismic Qualification Data: Certificates, for each VFC, accessories, and components, from manufacturer.
  1. Certificate of compliance.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based, and their installation requirements.
- D. Product Certificates: For each VFC from manufacturer.
- E. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranty: For special warranty.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 01730 "Installation, Operation, and Maintenance Manuals," include the following:
    - a. Manufacturer's record drawings as defined in UL 845 for controllers installed in MCCs or as described in Section 16928. In addition to requirements specified in UL 845, include field modifications and field assigned wiring identification incorporated during construction by manufacturer, Contractor or both.
    - b. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
    - c. Manufacturer's written instructions for setting field-adjustable overload relays.
    - d. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
    - e. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
    - f. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.
    - g. Warranty: Sample of special warranty.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  - 3. Indicating Lights: Two of each type and color installed.
  - 4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
  - 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

## 1.8 QUALITY ASSURANCE

- A. Source Limitations: Obtain VFCs and controllers of a single type from a single source from a single manufacturer.
- B. Electrical Components, Devices and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Testing Agency Qualifications: Accredited by NETA.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

- D. Comply with NFPA 70.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment to the job site at the appropriate time for installation and only after receiving final approval on Factory Acceptance Testing from the Engineer. Equipment items shall be crated or affixed to pallets with protective wrappings. Exercise care to prevent damage from handling. Store mechanical and electrical components off the ground in weathertight enclosures. Keep equipment dry at all times.
- B. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and install temporary electric heating, with at least 250 W per controller or connect factory installed space heaters to temporary electrical service.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

#### 1.10 COORDINATION

- A. Coordinate sizes and installation location of VFCs.
- B. Coordinate features of VFCs, installed units and accessory devices with remote pilot devices and control circuits to which they connect.
- C. Coordinate features, accessories and functions of each controller and each installed unit with ratings and characteristics of supply circuits, motors, required control sequences, and duty cycle of motors and loads.

#### 1.11 COORDINATION WITH CONTROL SYSTEM

- A. The CSI, as specified in Section 16928, shall be solely and completely responsible for coordination and integration of the Control System with the Motor Controllers.

#### 1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Five years from date of Substantial Completion.

### **PART 2 - PRODUCTS**

#### 2.1 MANUFACTURERS

- A. The following VFC was used as the basis of design. VFC submitted shall be the following, or approved equal.
  - 1. ABB ACS580-01-273A-2 wall mounted single phase drive.

## 2.2 SYSTEM DESCRIPTION

- A. General Requirements for VFCs:
  - 1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508C.
- B. Application: Constant torque and variable torque.
- C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
  - 1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."
  - 2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
  - 3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
  - 4. Listed and labeled for single-phase use by an NRTL acceptable to authorities having jurisdiction.
- D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range; maximum voltage equals input voltage.
- F. Unit Operating Requirements:
  - 1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
  - 2. Input AC Voltage Unbalance: Not exceeding 5 percent.
  - 3. Input Frequency Tolerance: plus or minus 3 percent of VFC frequency rating.
  - 4. Minimum Efficiency: 97 percent at 60 Hz, full load.
  - 5. Minimum Displacement Primary-Side Power Factor: 98 percent under any load or speed condition.
  - 6. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F with and average value exceeding 95 deg F over a 24-hour period.
  - 7. Humidity Rating: Less than 95 percent (noncondensing).
  - 8. Altitude Rating: Not exceeding 3300 feet.
  - 9. Vibration Withstand: Comply with NEMA ICS 61800-2.
  - 10. Overload Capability for Variable-Torque Applications: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.

11. Starting Torque for Constant Torque Applications: Minimum 100 percent of rated torque from 3 to 60 Hz.
  12. Speed Regulation: Plus or minus 1 percent of rated speed.
  13. Output Carrier Frequency: Selectable; 1 to 12 kHz.
  14. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- G. Inverter Logic: Microprocessor based, 16 bit, isolated from all power circuits.
- H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
1. Signal: Electrical.
- I. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
  2. Maximum Speed: 80 to 100 percent of maximum rpm.
  3. Acceleration: 0.1 to 999.9 seconds.
  4. Deceleration: 0.1 to 999.9 seconds.
  5. Current Limit: 30 to minimum of 150 percent of maximum rating.
- J. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors to provide three-phase protection against damage from supply voltage surges 10 percent or more above nominal line voltage.
  2. Surge Suppression: Factory installed as an integral part of the VFC, complying with Section 16483 "Surge-Protection for Low-Voltage Electrical Power Circuits".
- K. Surge Suppression: Field-mounted surge suppressors complying with Section 16483 "Surge Protection for Low-Voltage Electrical Power Circuits".
1. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
  2. Undervoltage and overvoltage trips.
  3. Inverter overcurrent trips.
  4. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
  5. Critical frequency rejection, with three selectable, adjustable deadbands.
  6. Instantaneous line-to-line and line-to-ground overcurrent trips.
  7. Loss-of-phase protection.
  8. Reverse-phase protection.
  9. Short-circuit protection.
  10. Motor-overtemperature fault.
- L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

- M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Auto speed Search" feature is available and engaged.
- N. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- O. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- P. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.
- Q. Integral Input Disconnecting Means and OCPD: UL 489, thermal-magnetic circuit breaker with pad-lockable, door-mounted handle mechanism.
  - 1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
  - 2. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
  - 3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
  - 4. NC alarm contact that operates only when circuit breaker has tripped.
- R. Control Power
  - 1. 120-VAC; obtained from CPT integral with controller size to be determined by the C.S.I based on loads served. The CPT shall be of sufficient capacity to operate integral devices and remotely located pilot, indicating and control devices with spare capacity as indicated.
    - a. Spare Capacity: 25% excess capacity.
  - 2. Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

## 2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

## 2.4 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
  - 1. Run.
  - 2. Drive Fault.
  - 3. Motor Overtemperature.



- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
  2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
    - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.
- C. Historical Logging Information and Displays:
1. Real-time clock with current time and date.
  2. Running log of total power versus time.
  3. Total run time.
  4. Fault log, maintaining last four faults with time and date stamp for each.
- D. Indicating Devices: Digital display and additional readout devices as required, mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
  2. Motor speed (rpm).
  3. Motor status (running, stop, fault).
  4. Motor current (amperes).
  5. Motor torque (percent).
  6. Fault or alarming status (code).
  7. PID feedback signal (percent).
  8. DC-link voltage (V dc).
  9. Set point frequency (Hz).
  10. Motor output voltage (V ac).
- E. Control Signal Interfaces:
1. Electric Input Signal Interface:
    - a. A minimum of two programmable analog inputs: 4- to 20-mA dc.
    - b. A minimum of six multifunction programmable digital inputs.
  2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:
    - a. 0- to 10-V dc.
    - b. 4- to 20-mA dc.
    - c. Potentiometer using up/down digital inputs.
    - d. Fixed frequencies using digital inputs.
  3. Output Signal Interface: A minimum of one programmable analog output signal(s) (4- to 20-mA dc), which can be configured for any of the following:
    - a. Output frequency (Hz).
    - b. Output current (load).
    - c. DC-link voltage (V dc).
    - d. Motor torque (percent).
    - e. Motor speed (rpm).
    - f. Set point frequency (Hz).

4. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
  - a. Motor running.
  - b. Set point speed reached.
  - c. Fault and warning indication (overtemperature or overcurrent).
  - d. PID high- or low-speed limits reached.
- F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
  1. Number of Loops: Two.
- G. PLC Interface: Factory-installed hardware and software to enable the PLC system to monitor, control and display VFC status, alarms and energy usage. Allows VFC to be used with an external system within a multidrop LAN configuration; settings retained within VFC's nonvolatile memory.
  1. Network Communications Ports: Ethernet and RS-422/485.
  2. Protocols for Network Communications: Ethernet TCP/IP; protocols accessible via the communications ports.

## 2.5 LINE CONDITIONING AND FILTERING

- A. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.
- B. Input Line Conditioning: 3 percent line reactor or as indicated on the drawings.
- C. Output Filtering: As indicated on the drawings.
- D. EMI/RFI Filtering: As indicated on the drawings.

## 2.6 BYPASS SYSTEMS (WHERE INDICATED ON THE DRAWINGS)

- A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
- B. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic-control system feedback.
- C. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller; with input isolating switch and barrier arranged to isolate the power converter input and output and permit safe testing and troubleshooting of the power converter, both energized and de-energized, while motor is operating in bypass mode.
  1. Bypass Contactor: Load-break, NEMA-rated contactor.

2. Input and Output Isolating Contactors: Non-load-break, NEMA-rated contactors.
  3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
- D. Bypass Contactor Configuration: Full-voltage (across-the-line) type.
1. NORMAL/BYPASS selector switch.
  2. HAND/OFF/AUTO selector switch.
  3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
  4. Contactor Coils: Pressure-encapsulated type with coil transient suppressors.
    - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
    - b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
  5. Control Circuits: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
    - a. CPT Spare Capacity: 25% excess capacity.
    - b. Solid-State Overload Relays:
      - 1) Switch or dial selectable for motor-running overload protection.
      - 2) Sensors in each phase.
      - 3) Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
    - c. NO isolated overload alarm contact.
    - d. External overload, reset push button.

## 2.7 OPTIONAL FEATURES

- A. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications when overload protection activates.
1. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.
  2. Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.
  3. Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.
- B. Damper control circuit with end-of-travel feedback capability.
- C. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.

- D. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.
- E. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- F. Remote digital operator kit.
- G. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of a notebook computer.

## 2.8 ENCLOSURES

- A. Controllers in MCC Compartments: Reference specification Section 16419.
- B. All Other Controllers: Reference specification Section 16928 for enclosure requirements.
- C. Provide corrosion inhibitors in all motor control enclosures prior to shipping. Amount of inhibitor shall be provided for the volume of the enclosure for one year.
- D. The construction of the enclosures shall comply with NEMA ICS 6.
- E. Controllers in hazardous (classified) locations shall comply with UL 1203.

## 2.9 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
  - 1. Push Buttons, Pilot Lights, and Selector Switches: Heavy-duty, oil-tight type. Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.
    - a. Push Buttons: Unguarded types; momentary contact unless otherwise indicated.
    - b. Pilot Lights: LED Types; push to test. As indicated in the controller schedule.
    - c. Selector Switches: Rotary Type.
- B. Reversible NC/NO bypass contactor auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable solid-state time-delay relays.
- D. Control Relays, General Purpose: Relays for general purpose use shall be DPDT or 3PDT, 10 amp contacts with appropriate coil voltage for the application. They shall have an 8-pin base, matching socket and contact status indicator.
- E. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.
- F. Supplemental Digital Meters:
1. Elapsed-time meter.
  2. Kilowatt meter.
  3. Kilowatt-hour meter.
- G. Space heaters, with NC auxiliary contacts, to mitigate condensation in enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- H. Cooling Fan and Exhaust System: Cooling fans shall maintain the enclosure rating of the enclosures in which they are installed. UL 508 component recognized: Supply fan, with stainless-steel intake and exhaust grills and filters; 120-V ac; obtained from integral CPT.
- I. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
- J. Spare control-wiring terminal blocks; wired.
- K. Terminal Blocks: Terminal boards shall be 300 or 600 volt modular terminal blocks with tubular screw and pressure plate. Terminal shall be sized to accept #2-14 AWG wire minimum. Provide a minimum of 20% or four (whichever is more) spare terminals in each bucket. Allen-Bradley Bulletin 1492-CA1 or approved equal.

## 2.10 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFCs according to requirements in NEMA ICS 61800-2.
1. Test each VFC while connected to a motor that is comparable to that for which the VFC is rated.
  2. Verification of Performance: Rate VFCs according to operation of functions and features specified.
- B. VFCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. It is the Contractor's responsibility to verify that the motor starters, protection equipment and other components provided are suitable (correct phase, voltage, starter type, breakers and overload relays) for the motors and equipment loads being served.
- B. Operator interface devices such as metering and devices with control and displays shall be installed between 5' and 5'-8" above finished floor. Operator interface devices on full height sections shall be installed between 4'-6" and 6' above finished floor.

- C. Provide wire and terminal numbering on all wires and terminals.
- D. Provide schematic and layout drawings for each individual unit.

### 3.2 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.
- B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.
- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between VFC and Knuckleboom Crane Control Panel. Comply with requirements in Section 16123 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control devices where applicable.
  - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
  - 2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

### 3.4 IDENTIFICATION

- A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 16153 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each VFC with engraved nameplate.
  - 3. Label each enclosure-mounted control and pilot device.
  - 4. Mark up a set of manufacturer's connection wiring diagrams with field assigned wiring identifications and return to manufacturer for inclusion in Record Drawings.

- B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

### 3.5 CONNECTIONS

- A. Comply with requirements for installation of conduit in Section 16133 “Raceways and Boxes for Electrical Systems.” Drawings indicate general arrangement of conduit, fittings and specialties.
- B. Comply with requirements in Section 16126 “Grounding and Bonding for Electrical Systems.”

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 “Electrical Testing”.

### 3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
  - 1. Complete installation and startup checks according to manufacturer's written instructions.

### 3.8 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Engineer before increasing settings.
- D. Set field-adjustable circuit-breaker trip ranges.
- E. Set field-adjustable pressure switches.

### 3.9 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.

- B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

### 3.10 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

**END OF SECTION**



## **SECTION 16480**

### **TRANSFER SWITCHES**

#### **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 automatic transfer switches rated 600 V and less, including the following:

##### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.
- B. Shop Drawings:
  - 1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
  - 2. Include material lists for each switch specified.
  - 3. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

##### **1.4 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Seismic Qualification Data: Certificates, for transfer switches, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 01730 "Operation and Maintenance Data," include the following:
    - a. Features and operating sequences, both automatic and manual.
    - b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

## 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications:
  - 1. Member company of NETA.
    - a. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

## 1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: Two years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA ICS 1.
- C. Comply with NFPA 99.
- D. Comply with NFPA 110.
- E. Comply with UL 1008 unless requirements of these Specifications are stricter.
- F. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- G. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.

1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
  2. Short-time withstand capability for 18 cycles.
- H. Repetitive Accuracy of Solid-State Controls: All settings shall be plus or minus 2 percent or better over an operating temperature range of minus 20 to plus 70 deg C.
- I. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- J. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.
- K. Service-Rated Transfer Switch:
1. Comply with UL 869A and UL 489.
  2. Provide terminals for bonding the grounding electrode conductor to the grounded service conductor.
  3. In systems with a neutral, the bonding connection shall be on the neutral bus.
  4. Provide removable link for temporary separation of the service and load grounded conductors.
  5. Surge Protective Device: Group A, Type 1; complying with Section 16483 "Surge Protection for Low-Voltage Electrical Power Circuits."
  6. Service Disconnecting Means: Externally operated, manual mechanically actuated.
- L. Neutral Terminal: Solid and fully rated unless otherwise indicated.
- M. Oversize Neutral: Ampacity and switch rating of neutral path through units indicated for oversize neutral shall be double the nominal rating of circuit in which switch is installed.
- N. Heater: Equip switches exposed to outdoor temperatures and humidity, and other units indicated, with an internal heater. Provide thermostat within enclosure to control heater.
- O. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.
- P. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed shrinkable sleeve markers at terminations. Color-coding and wire and cable markers are specified in Section 16153 "Identification for Electrical Systems."
1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
  2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.

3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
  4. Accessible via front access.
- Q. Enclosures: Rated for environmental conditions at installed location as defined in Section 16012 "Electrical General" or as indicated on the drawings.
1. General Purpose Areas: NEMA 250, Type 1.

## 2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Caterpillar, Inc.; Electric Power Division.
  2. Cummins Power Generation.
  3. Eaton.
  4. Kohler Power Systems.
  5. Generac
  6. MTU America Inc.
  7. ASCO Power Technologies.
- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
  2. Switch Action: Double throw; mechanically held in both directions.
  3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
  4. Conductor Connectors: Suitable for use with conductor material and sizes.
  5. Material: Hard-drawn copper, 98 percent conductivity.
  6. Main and Neutral Lugs: Mechanical type.
  7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  8. Ground bar.
  9. Connectors shall be marked for conductor size and type according to UL 1008.
- D. Automatic Open-Transition Transfer Switches: Interlocked to prevent the load from being closed on both sources at the same time.
1. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
- E. Electric Nonautomatic Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- F. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

- G. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
- H. Automatic Transfer-Switch Controller Features:
1. Controller operates through a period of loss of control power.
  2. Undervoltage Sensing for Each Phase of Normal and Alternate Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
  3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
  4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
  5. Test Switch: Simulate normal-source failure.
  6. Switch-Position Pilot Lights: Indicate source to which load is connected.
  7. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
    - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available."
    - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available."
  8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-V ac.
  9. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
  10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
  11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
  12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    - b. Push-button programming control with digital display of settings.
    - c. Integral battery operation of time switch when normal control power is unavailable.
- I. Large-Motor-Load Power Transfer:

1. Programmed Neutral Switch Position: Switch operator with programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Adjustable pause from 0.5 to 30 seconds minimum, and factory set for 0.5 second unless otherwise indicated. Time delay occurs for both transfer directions. Disable pause unless both sources are live.

## 2.3 MOLDED-CASE-TYPE AUTOMATIC TRANSFER SWITCHES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Caterpillar, Inc.; Electric Power Division.
  2. Cummins Power Generation.
  3. Eaton.
  4. Kohler Power Systems.
  5. Generac
  6. MTU America Inc.
  7. ASCO Power Technologies.
- B. Comply with Level 1 equipment according to NFPA 110.
- C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
  1. Limitation: Switches using contactor-based components are unacceptable.
  2. Switch Action: Double throw; mechanically held in both directions.
  3. Contacts: Silver composition or silver alloy for load-current switching.
  4. Conductor Connectors: Suitable for use with conductor material and sizes.
  5. Material: Hard-drawn copper, 98 percent conductivity.
  6. Main and Neutral Lugs: Mechanical type.
  7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
  8. Ground bar.
  9. Connectors shall be marked for conductor size and type according to UL 1008.
- D. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
  1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
  2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
  3. Fully automatic break-before-make operation with center off position.
- E. Manual Switch Operation: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

- F. Manual Switch Operation: Unloaded. Control circuit automatically disconnects from electrical operator during manual operation.
- G. Electric Nonautomatic Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.
- H. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.
- I. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.
- J. Transfer Switches Based on Molded-Case-Switch Components: Comply with UL 489 and UL 869A.
- K. Automatic Transfer-Switch Controller Features:
  - 1. Controller operates through a period of loss of control power.
  - 2. Undervoltage Sensing for Each Phase of Normal and Alternative Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
  - 3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
  - 4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
  - 5. Test Switch: Simulate normal-source failure.
  - 6. Switch-Position Pilot Lights: Indicate source to which load is connected.
  - 7. Source-Available Indicating Lights and Contacts: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
    - a. Normal Power Supervision: Green light with nameplate engraved "Normal Source Available." Provide single-pole, double-throw contacts for normal power available, rated 10 A at 240-VAC.
    - b. Emergency Power Supervision: Red light with nameplate engraved "Emergency Source Available." Provide single-pole, double-throw contacts for emergency power available, rated 10 A at 240-VAC.
  - 8. Unassigned Auxiliary Contacts: Two normally open, single-pole, double-throw contacts for each switch position, rated 10 A at 240-VAC.
  - 9. Transfer Override Switch: Overrides automatic retransfer control so automatic transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
  - 10. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-VDC minimum.

11. Engine Shutdown Contacts: Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
  12. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    - a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    - b. Push-button programming control with digital display of settings.
    - c. Integral battery operation of time switch when normal control power is unavailable.
- L. Large-Motor-Load Power Transfer:
1. Programmed Neutral Switch Position: Switch operator with programmed neutral position arranged to provide a midpoint between the two working switch positions, with an intentional, time-controlled pause at midpoint during transfer. Adjustable pause from 0.5 to 30 seconds minimum, and factory set for 0.5 second unless otherwise indicated. Time delay occurs for both transfer directions. Disable pause unless both sources are live.

## 2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.
- B. Prepare test and inspection reports.
1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
    - a. Overvoltage.
    - b. Undervoltage.
    - c. Loss of supply voltage.
    - d. Reduction of supply voltage.
    - e. Alternative supply voltage or frequency is at minimum acceptable values.
    - f. Temperature rise.
    - g. Dielectric voltage-withstand; before and after short-circuit test.
    - h. Overload.
    - i. Contact opening.
    - j. Endurance.
    - k. Short circuit.
    - l. Short-time current capability.
    - m. Receptacle withstand capability.
    - n. Insulating base and supports damage.



## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Floor-Mounting Switch: Anchor to floor by bolting.
  - 1. Install transfer switches on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03300 "Cast-in-Place Concrete."
  - 2. Comply with requirements for seismic control devices specified in Section 16418 "Seismic Controls for Electrical Systems."
  - 3. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases.
  - 4. Provide workspace and clearances required by NFPA 70.
- B. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.
- C. Identify components according to Section 16153 "Identification for Electrical Systems."
- D. Set field-adjustable intervals and delays, relays, and engine exerciser clock.
- E. Comply with NECA 1.

### **3.2 CONNECTIONS**

- A. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
  - 1. Comply with requirements for raceways and boxes specified in Section 16133 "Raceways and Boxes for Electrical Systems."
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
- C. Ground equipment according to Section 16126 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 16119 "Low-Voltage Electrical Power Conductors and Cables."
- E. Connect twisted pair cable according to Section 16123 "Control-Voltage Electrical Power Cables."
- F. Route and brace conductors according to manufacturer's written instructions and Section 16129 "Hangers and Supports for Electrical Systems." Do not obscure manufacturer's markings and labels.
- G. Brace and support equipment according to Section 16148 "Seismic Controls for Electrical Systems."
- H. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

### 3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in section 266700 “Electrical Testing.”

### 3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.
- B. Training shall include testing ground-fault protective devices and instructions to determine when the ground-fault system shall be retested. Include instructions on where ground-fault sensors are located and how to avoid negating the ground-fault protection scheme during testing and circuit modifications.
- C. Coordinate this training with that for generator equipment.

**END OF SECTION**

## SECTION 16483

### SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes:
  - 1. Surge protection for electrical distribution equipment.
  - 2. Surge protection for control panels, motor control panels, telemetry panels and other sensitive electronic equipment.
  - 3. Surge protection for data communications, signaling and control circuits.
  - 4. Enclosures.
  - 5. Conductors and cables.

##### 1.3 DEFINITIONS

- A. Inominal: Nominal discharge current. The peak value of the current that can be passed through the SPD having a waveshape of 8/20 $\mu$ S where the SPD remains functional after 15 surges.
- B. I<sub>max</sub>: Maximum surge rating when a device is subjected to a single 8/20 $\mu$ S waveshape that it can withstand with degradation to the SPD.
- C. MCOV: Maximum continuous operating voltage.
- D. Mode(s), also Modes of Protection: air of electrical connections where the VPR applies.
- E. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- F. NRTL: Nationally recognized testing laboratory.
- G. OCPD: Overcurrent protective device.
- H. SCCR: Short-circuit current rating.
- I. SPD: Surge protective device.
- J. TOV: Temporary Over Voltage

- K. Type 1 SPDs: Permanently connected SPDs intended for installation between the secondary of the service transformer and the line side of the service disconnect overcurrent device.
- L. Type 2 SPDs: Permanently connected SPDs intended for installation on the load side of the service disconnect overcurrent device, including SPDs located at the branch panel.
- M. Type 3 SPDs: Point of utilization SPDs.
- N. Type 4 SPDs: Component SPDs, including discrete components, as well as assemblies.
- O. Type 5 SPDs: Discrete component surge suppressors, such as MOVs that may be mounted on a printed wiring board, connected by its leads or provided within an enclosure with mounting means and wiring terminations.
- P. VPR: Voltage protection rating.

#### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include electrical characteristics, specialties, and accessories for SPDs.
  - 2. NRTL certification of compliance with UL 1449.
    - a. Tested values for VPRs.
    - b. Inominal ratings.
    - c. MCOV, type designations.
    - d. OCPD requirements.
    - e. Manufacturer's model number.
    - f. System voltage.
    - g. Modes of protection.

#### 1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

#### 1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace SPDs that fail in materials or workmanship within five years from date of Substantial Completion.

#### 1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

- B. Comply with IEEE C62.41.2 and test devices according to IEEE C62.45.

## 1.9 PROJECT CONDITIONS

- A. Service Conditions: SPDs shall be rated for continuous operation under the following conditions unless otherwise indicated:
  - 1. Operating Temperature: -30 to 130 degrees F.
  - 2. Humidity: 0 to 95 percent, noncondensing.
  - 3. Altitude: Less than 12,000 feet above sea level.

## PART 2 - PRODUCTS

### 2.1 DISTRIBUTION SYSTEM SURGE PROTECTION DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Citel
  - 2. Eaton
  - 3. Schneider Electric USA, Inc.
  - 4. Siemens Industry, Inc., Energy Management Division.
- B. Design Categories: SPDs shall be coordinated with the electrical distribution system based on the following three categories.
  - 1. Category A: Includes all service entrance equipment and any 480V and higher distribution equipment serving equipment exposed to outside surges.
  - 2. Category B: Includes all 480V distribution equipment serving loads including, but not limited to, panelboards, switchboards, switchgear and motor control centers.
  - 3. Category C: Includes branch panelboards and load centers that are not exposed to outside surges and power only local, low-voltage loads.
- C. Source Limitations: Obtain devices from a single source from a single manufacturer.
- D. Standards: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1449, 4<sup>th</sup> Edition, Type 1.
- E. General Requirements for Service Entrance SPDs:
  - 1. Devices shall be connected in parallel. Series connected devices will not be accepted.
  - 2. Units shall have thermally protected MOVs, individually fused.
  - 3. Units shall simultaneously monitor each MOV and provide visual indication of protection status.
  - 4. Units shall have Form C dry contacts for remote alarm indication.
  - 5. MCOV: Not less than 125 percent of nominal system voltage.
- F. Requirements for Category A SPDs:
  - 1. Description: Integral units.
  - 2. Inominal: 20kA.
  - 3. Surge Current Rating: 100kA (per mode), 240kA (per phase) or higher.

4. UL Short Circuit Current Rating (SCCR): 200kA
5. Protection for all applicable modes, differential (L-L, L-N) and common (L-G, N-G).
6. Voltage Protection Ratings not to exceed the following:
  - a. 120/240V, high-leg, single-phase, three-wire:
    - 1) L-G, N-G: 700 V.
    - 2) N-G: 700 V.
    - 3) L-N: 700 V.
    - 4) L-L: 1200 V.
  - b. 120/240V, high-leg, three-phase, four-wire:
    - 1) L-G: 1200 V.
    - 2) N-G: 800 V.
    - 3) L-N: 1200 V.
    - 4) L-L: 2000 V.
  - c. 208Y/120V, three-phase, four-wire:
    - 1) L-G: 900 V.
    - 2) N-G: 900 V.
    - 3) L-N: 900 V.
    - 4) L-L: 1200 V.
  - d. 480Y/277, three-phase, four-wire:
    - 1) L-G: 1200 V.
    - 2) N-G: 1200 V.
    - 3) L-N: 1200 V.
    - 4) L-L: 2000 V.

- G. Requirements for Category B SPDs:
1. Inominal: 20kA.
  2. Surge Current Rating: 50kA (per mode), 150kA (per phase) or higher.
  3. SCCR: 200kA.
  4. Protection for all applicable modes, differential (L-L, L-N) and common (L-G, N-G).
  5. Voltage Protection Ratings not to exceed the following:
    - a. 120/240V, high-leg, single-phase, three-wire:
      - 1) L-G: 700 V.
      - 2) N-G: 700 V.
      - 3) L-N: 700 V.
      - 4) L-L: 1200 V.
    - b. 120/240 V, high-leg, three-phase, four-wire:
      - 1) L-G: 1200 V.
      - 2) N-G: 800 V.
      - 3) L-N: 1200 V.
      - 4) L-L: 2000 V.
    - c. 208Y/120V, three-phase, four-wire:
      - 1) L-G: 700 V.
      - 2) N-G: 700 V.
      - 3) L-N: 700 V.
      - 4) L-L: 1200 V.
    - d. 480Y/277V, three-phase, four-wire:
      - 1) L-G: 1200 V.
      - 2) N-G: 1200 V.

- 3) L-N: 1200 V.
- 4) L-L: 2000 V.

H. Requirements for Category C SPDs:

1. Description: Integral or nipple-mounted units.
2. Inominal: 10kA.
3. Surge Current Rating: 40kA (per mode), 40kA (per phase) or higher.
4. SCCR: 200kA.
5. Protection for all applicable modes, differential (L-L, L-N) and common (L-G, N-G).
6. Voltage Protection Ratings not to exceed the following:
  - a. 120/240V, high-leg, single-phase, three-wire:
    - 1) L-G: 700 V.
    - 2) N-G: 700 V.
    - 3) L-N: 700 V.
    - 4) L-L: 1200 V.
  - b. 120/240 V, high-leg, three-phase, four-wire:
    - 1) L-G: 1200 V.
    - 2) N-G: 800 V.
    - 3) L-N: 1200 V.
    - 4) L-L: 2000 V.
  - c. 208Y/120V, three-phase, four-wire:
    - 1) L-G: 700 V.
    - 2) N-G: 700 V.
    - 3) L-N: 700 V.
    - 4) L-L: 1200 V.
  - d. 480Y/277V, three-phase, four-wire:
    - 1) L-G: 1200 V.
    - 2) N-G: 1200 V.
    - 3) L-N: 1200 V.
    - 4) L-L: 2000 V.

I. Enclosures: SPDs not mounted integrally with the equipment shall be NEMA 4X rated.

## 2.2 SURGE PROTECTIVE DEVICES FOR DATA, SIGNALING AND CONTROL CIRCUITS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the work include, but are not limited to, the following:
1. nVent ERICO.
  2. Phoenix Contact.
  3. Transtector.
  4. Eaton, MTL.
  5. RayCap.
  6. Citel.
- B. Description: Application specific surge protective devices used to protect low voltage ac and dc control, signaling and data circuits and related instrumentation.
- C. Source Limitations: Obtain devices from a single source from a single manufacturer.

- D. Standards: Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 497B for isolated loop communications circuits.
- E. Bandwidth: All data, signaling and control circuit SPDs shall be selected by the CSI for the bandwidth and frequency requirements of the application.
- F. SPDs for 4-20mA Current Loops:
1. Description: DIN-Rail mounted, Pluggable SPD modules for easy maintenance.
  2. Performance Requirements:
    - a. MCOV: Not less than 125% of nominal system voltage.
    - b. Inominal: 5kA or higher.
    - c. Imax: 20kA.
    - d. Protection Modes: Differential and common.
    - e. Voltage Protection Rating: 46V.
- G. SPDs for 4-20mA Remote Transmitter Protection:
1. Description: Stainless steel enclosure threaded in-line with field conduit or to spare  $\frac{3}{4}$ " NPT threaded transmitter connection port or provided integral with instrumentation.
  2. Performance Requirements:
    - a. MCOV: Not less than 125% of nominal system voltage.
    - b. Inominal: 5kA or higher.
    - c. Imax: 20kA.
    - d. Protection Modes: Differential and common.
    - e. Voltage Protection Rating: 46V.
- H. SPDs for telecommunications circuits:
1. Performance Requirements:
    - a. MCOV: Not less than 125% of nominal system voltage.
    - b. Inominal: 5kA.
    - c. Imax: 20kA.
    - d. Maximum Line Current: 300mA.
    - e. Voltage Protection Rating: Not to exceed 140 V.
- I. SPDs for Ethernet and POE:
1. Standards:
    - a. Ethernet: Comply with IEEE 802.3af and 802.3av.
    - b. POE: Comply with IEEE 802.3at.
  2. Description: DIN-rail mounted surge protection for ethernet and POE applications.
  3. Performance Requirements:
    - a. Data Rate: 1000 Mbps.
    - b. Inominal (L-L): 100A or higher.
    - c. Inominal (L-G): 2kA or higher.
    - d. Imax: 10kA or higher.
    - e. Connections: Shielded RJ45.
- J. SPDs for RS-232/RS-485 protocols:
1. Description: DIN-Rail mounted, Pluggable SPD modules for easy maintenance.
  2. Performance Requirements:



- a. MCOV: Not less than 125% of nominal system voltage.
    - b. Inominal: 5kA.
    - c. Maximum Line Current: 600mA.
    - d. Voltage Protection Rating (8/20  $\mu$ S, 5kA): 40V.
  - K. SPDs for Radio Communications Systems:
    - 1. Description: Bulkhead lightning arrestors for protection of coaxial RF antenna systems suitable for frequencies from DC to 2.6GHz.
    - 2. Performance Requirements:
      - a. Insertion Loss: Less than or equal to 0.1 dB.
      - b. Standing Wave Ratio: Less than or equal to 1.15.
    - 3. CSI shall coordinate required input power ratings and system impedance as required.
- 2.3 ENCLOSURES
- A. Externally Mounted SPDs: NEMA 250, Type 4X.
- 2.4 CONDUCTORS AND CABLES
- A. Power Wiring: Same size as SPD leads, complying with Section 16119 "Low-Voltage Electrical Power Conductors and Cables."

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

- A. Comply with NECA 1.
- B. Provide OCPD and disconnect for installation of SPD in accordance with UL 1449 and manufacturer's written instructions.
- C. Install leads between disconnects and SPDs short, straight, twisted, and in accordance with manufacturer's written instructions. Comply with wiring methods in Section 16119 "Low-Voltage Electrical Power Conductors and Cables."
  - 1. Do not splice and extend SPD leads unless specifically permitted by manufacturer.
  - 2. Do not exceed manufacturer's recommended lead length.
  - 3. Install SPDs with leads as short as practicable. Integral and external units shall be installed as near as practicable to bus termination points.
  - 4. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.

#### **3.2 FIELD QUALITY CONTROL**

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

### 3.3 STARTUP SERVICE

- A. Complete startup checks in accordance with manufacturer's written instructions.
- B. Do not perform insulation-resistance tests of the distribution wiring equipment with SPDs installed. Disconnect SPDs before conducting insulation-resistance tests; reconnect them immediately after the testing is over.
- C. Energize SPDs after power system has been energized, stabilized, and tested.

### 3.4 DEMONSTRATION

- A. Train Owner's maintenance personnel to operate and maintain SPDs.

**END OF SECTION**

## SECTION 16519

### LED INTERIOR LIGHTING

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section includes the following types of LED luminaires:
  - 1. Cylinder.
  - 2. Downlight.
  - 3. Highbay, linear.
  - 4. Highbay, nonlinear.
  - 5. Linear industrial.
  - 6. Lowbay.
  - 7. Strip light.
  - 8. Surface mount, linear.
  - 9. Surface mount, nonlinear.
  - 10. Suspended, linear.
  - 11. Suspended, nonlinear.

##### 1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

##### 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaires.
  - 4. Include emergency lighting units, including batteries and chargers.

5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  6. Photometric data and adjustment factors based on laboratory tests, complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project, IES LM-79 and IES LM-80.
    - a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products or a qualified independent testing agency.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Luminaires.
  2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
  4. Structural members to which equipment and or luminaires will be attached.
  5. Structural members to which suspension systems for lighting fixtures will be attached.
  6. Initial access modules for acoustical tile, including size and locations.
  7. Items penetrating finished ceiling including, but not limited to, the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Sprinklers.
    - d. Access panels.
    - e. Occupancy sensors.
    - f. Smoke and fire detectors.
  8. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- F. Quality Control: Source quality-control reports.
- G. Sample Warranty: For manufacturer's standard warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Drivers: One for every 10 of each type and rating installed. Furnish at least one of each type.
  2. Surge Protective Devices: Where a surge protective device is furnished by the manufacturer as an integral part of the Luminaire, provide one for every 10 of each type and rating installed. Furnish at least one of each type.
  3. Lamps/LED Modules: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
  4. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  5. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provide laboratory qualifications for the testing laboratory used. Acceptable qualifications include the following:
1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products and complying with the applicable IES testing standards.
  2. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

- B. Provide luminaires from a single manufacturer for each luminaire type.

#### 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

#### 1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five years from date of Substantial Completion.
- C. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine (9) years.
  - 2. Warranty Period for Emergency Fluorescent Ballast and Self-Powered Exit Sign Batteries: Seven (7) years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six (6) years.

### PART 2 - PRODUCTS

#### 2.1 LUMINAIRE SCHEDULE

- A. General requirements for all interior luminaires follow below. For specific requirements, reference the Luminaire Schedule included in the Electrical Plan Sheets of the Contract Documents.

#### 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
- C. Ambient Temperature: 41 to 104 deg F (or) 5 to 104 deg F.
- D. Relative Humidity: Zero to 95 percent.
- E. Altitude: Sea level to 3000 feet.

## 2.3 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

## 2.4 MATERIALS

- A. Metal Parts:
- B. Free of burrs and sharp corners and edges.
- C. Sheet metal components shall be steel unless otherwise indicated.
- D. Form and support to prevent warping and sagging.
- E. Steel:
  - 1. ASTM A36/A36M for carbon structural steel.
  - 2. ASTM A568/A568M for sheet steel.
- F. Stainless Steel:
  - 1. Manufacturer's standard grade.
  - 2. Manufacturer's standard type, ASTM A240/240M.
- G. Galvanized Steel: ASTM A653/A653M.
- H. Aluminum: ASTM B209.

## 2.5 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in finish are not acceptable.

## 2.6 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 16129 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, threaded stainless-steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. Permanent luminaires shall not be used for temporary lighting.

### 3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps or LED modules, drivers, surge protection devices and all other appurtenances required in each luminaire.
- D. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.



- E. Flush-Mounted Luminaires:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- F. Wall-Mounted Luminaires:
  - 1. Attached to structural members in walls.
  - 2. Do not attach luminaires directly to gypsum board.
- G. Remote Mounting of Ballasts: Distance between the ballast and fixture shall not exceed that recommended by the ballast manufacturer. Verify, with ballast manufacturers, maximum distance between ballast and luminaire.
- H. Suspended Luminaires:
  - 1. Ceiling Mount:
    - a. Two 5/32-inch-diameter aircraft cable supports adjustable to 10 feet in length.
    - b. Four-point pendant mount with 5/32-inch-diameter aircraft cable supports adjustable to 10 feet in length.
    - c. Hook mount.
  - 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
  - 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  - 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
  - 5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- I. Ceiling-Grid-Mounted Luminaires:
  - 1. Secure to any required outlet box.
  - 2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
  - 3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- J. Air-Handling Lighting Fixtures: Install with dampers closed and ready for adjustment.
- K. Comply with requirements in Section 16119 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### 3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16153 "Identification for Electrical Systems."

### 3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

### 3.6 STARTUP SERVICE

- A. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Owner. Burn-in LED lamps intended to be dimmed, for at least 100 hours at full voltage.

### 3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
  - 1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  - 2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 3. Adjust the aim of luminaires in the presence of the Engineer.

**END OF SECTION**

## **SECTION 16539**

### **LED EXTERIOR LIGHTING**

#### **PART 1 - GENERAL**

##### **1.1 RELATED DOCUMENTS**

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

##### **1.2 SUMMARY**

- A. Section Includes:
  - 1. Exterior solid-state luminaires that are designed for and exclusively use LED lamp technology.
  - 2. Luminaire supports.
  - 3. Luminaire-mounted photoelectric relays.
- B. Related Requirements:
  - 1. Section 16533 "Lighting Poles and Standards" for poles and standards used to support exterior lighting equipment.

##### **1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color rendering index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. Lumen: Measured output of lamp and luminaire, or both.
- F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

##### **1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of luminaire.
  - 1. Arrange in order of luminaire designation.
  - 2. Include data on features, accessories, and finishes.
  - 3. Include physical description and dimensions of luminaire.
  - 4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
  - 5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories

identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

- a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products or a qualified independent testing agency.
6. Photoelectric relays.
- B. Shop Drawings:
  1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Luminaires.
  2. Structural members to which equipment and luminaires will be attached.
  3. Underground utilities and structures.
  4. Existing underground utilities and structures.
  5. Above-grade utilities and structures.
  6. Existing above-grade utilities and structures.
  7. Building features.
  8. Vertical and horizontal information.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Data: For luminaires, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
  4. devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of the following:
  1. Luminaire.
  2. Photoelectric relay.

- E. Product Test Reports: For each luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.
- F. Quality Control: Source quality-control reports.
- G. Sample Warranty: For manufacturer's standard warranty.

#### 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
  - 1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
  - 2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

#### 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Drivers: One for every 10 of each type and rating installed. Furnish at least one of each type.
  - 2. Surge Protective Devices: Where a surge protective device is furnished by the manufacturer as an integral part of the Luminaire, provide one for every 10 of each type and rating installed. Furnish at least one of each type.
  - 3. Lamps/LED Modules: Ten for every 100 of each type and rating installed. Furnish at least one of each type.
  - 4. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  - 5. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

#### 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Provide laboratory qualifications for the testing laboratory used. Acceptable qualifications include the following:
  - 1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products and complying with the applicable IES testing standards.
  - 2. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.
- B. Provide luminaires from a single manufacturer for each luminaire type.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

## 1.10 FIELD CONDITIONS

- A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.
- B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

## 1.11 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures, including luminaire support components.
    - b. Faulty operation of luminaires and accessories.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  - 2. Warranty Period: 5 years from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.1 LUMINAIRE SCHEDULE

- A. General requirements for all exterior luminaires follow below. For specific requirements, reference the Luminaire Schedule included in the Electrical Plan Sheets in the Contract Documents.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.

## 2.3 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage and coating.
    - c. CCT and CRI for all luminaires.
- C. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.
- D. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- E. UL Compliance: Comply with UL 1598 and listed for wet location.
- F. Lamp base complying with ANSI C81.61.
- G. Bulb shape complying with ANSI C79.1.

## 2.4 MATERIALS

- A. Metal Parts: Free of burrs and sharp corners and edges.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.
- C. Housings:
  - 1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
  - 2. Provide filter/breather for enclosed luminaires.

## 2.5 FINISHES

- A. Appearance of Finished Work: Noticeable variations in finish are not acceptable.
- B. Comply with division 9.
- C. Luminaire Finish: Manufacturer's standard paint and color unless otherwise indicated on the Luminaire Schedule applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.
- D. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- E. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
  1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.

## 2.6 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 16129 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.
- C. Examine walls, roofs, canopy ceilings and overhang ceilings for suitable conditions where luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 TEMPORARY LIGHTING

- A. Permanent luminaires shall not be used for temporary lighting.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Comply with NECA 1.
- B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.
- C. Install lamps or LED modules, drivers, surge protection devices and all other appurtenances required in each luminaire.
- D. Fasten luminaire to structural support.



- E. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and relamping.
  - 3. Support luminaires without causing deflection of finished surface.
  - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- F. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members in walls.
- G. Wiring Method: Install cables in raceways. Conceal raceways and cables.
- H. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.
- I. Install luminaires at height and aiming angle as indicated on Drawings.
- J. Coordinate layout and installation of luminaires with other construction.
- K. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.
- L. Comply with requirements in Section 160119 "Low-Voltage Electrical Power Conductors and Cables" and Section 16133 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

### 3.4 CORROSION PREVENTION

- A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

### 3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16153 "Identification for Electrical Systems."

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in section 16670 "Electrical Testing".

### 3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaires and photocell relays.

### 3.8 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
  2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  3. Adjust the aim of luminaires in the presence of the Engineer.

**END OF SECTION**

## SECTION 16541

### LIGHTING CONTROL DEVICES

#### PART 1 - GENERAL

##### 1.1 RELATED DOCUMENTS

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

##### 1.2 SUMMARY

- A. Section Includes:
  - 1. Photoelectric switches.
  - 2. Indoor occupancy sensors.
  - 3. Switchbox-mounted occupancy sensors.
  - 4. Outdoor motion sensors.
  - 5. Lighting contactors.
- B. Related Requirements:
  - 1. Section 16426 "Wiring Devices" for wall-box dimmers, non-networkable wall-switch occupancy sensors, and manual light switches.

##### 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
  - 1. Show installation details for the following:
    - a. Occupancy sensors.
  - 2. Interconnection diagrams showing field-installed wiring.
  - 3. Include diagrams for power, signal, and control wiring.

##### 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and elevations, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Suspended ceiling components.
  - 2. Structural members to which equipment will be attached.
  - 3. Items penetrating finished ceiling, including the following:
    - a. Luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.
    - e. Access panels.
    - f. Control modules.

- B. Field quality-control reports.
- C. Sample Warranty: For manufacturer's warranties.

## 1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each type of lighting control device to include in operation and maintenance manuals.
- B. Software and Firmware Operational Documentation:
  - 1. Software operating and upgrade manuals.
  - 2. Program Software Backup: On USB media. Provide names, versions, and website addresses for locations of installed software.
  - 3. Device address list.
  - 4. Printout of software application and graphic screens.

## 1.6 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace lighting control devices that fail(s) in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Faulty operation of lighting control software.
    - b. Faulty operation of lighting control devices.
  - 2. Warranty Period: Two year(s) from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, FLEXIBLE MOUNTING

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Eaton.
  - 2. Intermatic, Inc.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. NSi Industries LLC.
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A, and compatible with ballasts and LED lamps.
  - 1. Listed and labeled as defined in NFPA 70, by an NRTL agency, and marked for intended location and application.
  - 2. Time Delay: Fifteen-second minimum, to prevent false operation.
  - 3. Surge Protection: Metal-oxide varistor.
  - 4. Mounting: Twist lock complies with ANSI C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure from same source and manufacturer as switch.
  - 5. Failure Mode: Luminaire stays ON.

## 2.2 OUTDOOR PHOTOELECTRIC SWITCHES, SOLID STATE, LUMINAIRE-MOUNTED

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Eaton.
  - 2. Intermatic, Inc.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. NSi Industries LLC.
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA inductive, to operate connected load, complying with UL 773, and compatible with CFL and LED lamps.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Time Delay: Thirty-second minimum, to prevent false operation.
  - 3. Lightning Arrester: Air-gap type.
  - 4. Mounting: Twist lock complying with ANSI C136.10, with base from same source and manufacturer as switch.
  - 5. Failure Mode: Luminaire stays ON.

## 2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Eaton.
  - 2. Lutron Electronics Co., Inc.
  - 3. Hubbell Incorporated (Hubbell Control Solutions).
- B. General Requirements for Sensors:
  - 1. Wall-mounted, ceiling-mounted or integral with the fixture as indicated on the drawings, solid-state indoor occupancy and vacancy sensors.
  - 2. Passive infrared technology.
  - 3. Separate power pack.
  - 4. Wireless communication with switch/fixtures; and BAS and lighting control system.
  - 5. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 6. Operation:
    - a. Occupancy Sensor: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time-delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 7. Sensor Output: Wireless.
  - 8. Power: Line voltage.
  - 9. Power Pack: Dry contacts rated for 20-A LED load at 120- and 277-V ac and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  - 10. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.

- b. Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
  - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
- 11. Bypass Switch: Override the "on" function in case of sensor failure.
- 12. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; turn lights off when selected lighting level is present.
- C. PIR Type: Detect occupants in coverage area by their heat and movement.
  - 1. Detector Sensitivity: Detect occurrences of 6-inch- minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.
  - 2. Detection Coverage (Room, Ceiling Mounted): Detect occupancy anywhere in a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
  - 3. Detection Coverage (Corridor, Ceiling Mounted): Detect occupancy within 90 feet when mounted on a 10-foot-high ceiling.
  - 4. Detection Coverage (Room, Wall Mounted): Detect occupancy anywhere within a 180-degree pattern centered on the sensor over an area of 1000 square feet when mounted 48 inches above finished floor.

## 2.4 SWITCHBOX-MOUNTED OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  - 1. Eaton.
  - 2. Lutron Electronics Co., Inc.
  - 3. Hubbell Incorporated (Hubbell Control Solutions).
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor with manual on-off switch, suitable for mounting in a single gang switchbox using wireless connection for controls and hardwired for power.
  - 1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  - 2. Occupancy Sensor Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn lights off when unoccupied; with a time-delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  - 3. Operating Ambient Conditions: Dry interior conditions, 32 to 120 deg F.
  - 4. Switch Rating: Not less than 800-VA LED load at 120 V, 1200-VA LED load at 277 V.

## 2.5 OUTDOOR MOTION SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper Industries, Inc.
  - 2. Hubbell Incorporated (Hubbell Control Solutions).
  - 3. Leviton Manufacturing Co., Inc.
- B. Description: Solid-state outdoor motion sensors.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. PIR type, weatherproof. Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. Comply with UL 773A.
3. Switch Rating:
  - a. Luminaire-Mounted Sensor: Dry contacts rate for 20-A LED load at 120- and 277-V ac and for 1 hp at 120-V ac. Sensor has 24 Vdc.
  - b. Separately Mounted Sensor: Dry contacts rated for 20-A LED load at 120- and 277-V ac, and for 1 hp at 120-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
4. Switch Type: SP.
5. Voltage: Match the circuit voltage.
6. Detector Coverage:
  - a. Standard Range: 210-degree field of view, with a minimum coverage area of 900 sq. ft.
  - b. Long Range: 180-degree field of view and 110-foot detection range.
7. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from 10 to 150 fc. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
8. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
9. Operating Ambient Conditions: Suitable for operation in ambient temperatures ranging from minus 40 to plus 130 deg F, rated as "raintight" according to UL 773A.

## 2.6 LIGHTING CONTACTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. ABB (Electrification Products Division).
  2. Allen-Bradley/Rockwell Automation.
  3. ASCO: a brand of Vertiv.
  4. Eaton.
  5. Leviton Manufacturing Co., Inc.
  6. Schneider Electric USA (Square D).
- B. Description: Electrically operated and electrically held, combination-type lighting contactors with-nonfused disconnect, complying with NEMA ICS 2 and UL 508.
  1. Current Rating for Switching: Listing or rating consistent with type of load served.
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine lighting control devices before installation. Reject lighting control devices that are wet, moisture damaged, or mold damaged.
- B. Examine walls and ceilings for suitable conditions where lighting control devices will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 SENSOR INSTALLATION**

- A. Comply with NECA 1.
- B. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- C. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

### **3.3 CONTACTOR INSTALLATION**

- A. Comply with NECA 1.
- B. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

### **3.4 WIRING INSTALLATION**

- A. Comply with NECA 1.
- B. Wiring Method: Comply with Section 16119 "Low-Voltage Electrical Power Conductors and Cables." for conductors and Sections 16133, 16136 and 16143 as required for raceways.
- C. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- D. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- E. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.



### 3.5 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 16153 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections as specified in Section 16670 "Electrical Testing".

### 3.7 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting lighting control devices to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
  - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
  - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

### 3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

### 3.9 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

## **END OF SECTION**

## **SECTION 16670**

### **ELECTRICAL TESTING**

#### **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. Electrical test and inspection requirements for all electrical equipment, motors, instruments and components.

##### **1.3 GENERAL DESCRIPTION OF WORK**

- A. General: Provide testing of electrical work installed under division 16, as specified herein and in other Division 16 sections. Feeders and equipment shall not be placed in service until they have been checked out and tested, as applicable.
- B. The following will be tested as indicated in this section:
  - 1. Transformers.
  - 2. Distribution and motor feeders.
  - 3. Molded-case circuit breakers.
  - 4. Instrument transformers.
  - 5. Metering devices.
  - 6. Grounding systems.
  - 7. Ground fault system.
  - 8. Motors.
  - 9. Motor Controls, Motor Starters and Motor Control Centers.
  - 10. Adjustable speed drives.
  - 11. Surge Protective Devices.
  - 12. Automatic transfer switches.
  - 13. Conductors.
  - 14. System Function.

##### **1.4 QUALITY ASSURANCE**

- A. Qualifications of the testing organization and personnel:
  - 1. Testing Organization:
    - a. The testing organization shall be an independent, third party entity which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated.
    - b. The testing organization shall be regularly engaged in the testing of electrical equipment devices, installations, and systems.

- c. The testing organization shall use technicians who are regularly employed for testing services.
  - d. The testing organization shall submit appropriate documentation to demonstrate that it satisfactorily complies with these requirements.
- 2. Testing Personnel:
  - a. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
  - b. Technicians shall be certified in accordance with ANSI/NETA ETT-2000, Standard for Certification of Electrical Testing Personnel. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing.
- B. The Engineer reserves the right to require that the originally approved personnel be replaced with other qualified personnel if, in his opinion, the original personnel are not qualified or are not properly conducting the system testing.

## 1.5 DIVISION OF RESPONSIBILITY

- A. The Owner's Representative:
  - 1. The Owner's representative shall provide the testing organization with the following:
    - a. A complete set of electrical plans and specifications, including all change orders.
    - b. Drawings and instruction manuals applicable to the scope of work.
    - c. An itemized description of equipment to be inspected and tested.
    - d. A determination of who shall provide a suitable and stable source of electrical power to each test site.
    - e. A determination of who shall perform certain preliminary low-voltage insulation-resistance, continuity, and/or low-voltage motor rotation tests prior to and in addition to tests specified herein.
    - f. Notification of when equipment becomes available for acceptance tests. Work shall be coordinated to expedite project scheduling.
    - g. Site-specific hazard notification and safety training.
  - 2. The testing organization shall provide the following:
    - a. All field technical services, tooling, equipment, instrumentation, and technical supervision to perform such tests and inspections.
    - b. Specific power requirements for test equipment.
    - c. Notification to the user prior to commencement of any testing.
    - d. A timely notification of any system, material, or workmanship that is found deficient based on the results of the acceptance tests.
    - e. A written record of all tests and a final report.

## 1.6 SAFETY AND PRECAUTIONS

- A. All parties involved must be cognizant of applicable safety procedures. This document does not include any procedures, including specific safety procedures. It is recognized

that an overwhelming majority of the tests and inspections recommended in these specifications are potentially hazardous. Individuals performing these tests shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved.

- B. Safety practices shall include, but are not limited to, the following requirements:
  - 1. All applicable provisions of the Occupational Safety and Health Act, particularly OSHA 29CFR 1910.
  - 2. Accident Prevention Manual for Industrial Operations, National Safety Council.
  - 3. Applicable state and local safety operating procedures.
  - 4. Owner's safety practices.
  - 5. ANSI/NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces.
- C. A safety lead person shall be identified prior to commencement of work.
- D. A safety briefing shall be conducted prior to the commencement of work.
- E. All tests shall be performed with the apparatus de-energized and grounded except where otherwise specifically required to be ungrounded or energized for certain tests.
- F. The testing organization shall have a designated safety representative on the project to supervise operations with respect to safety. This individual may be the same person described in 1.5.A.2.

#### 1.7 SUITABILITY OF TEST EQUIPMENT

- A. All test equipment shall meet the requirements in Section 1.8 and be in good mechanical and electrical condition.
- B. Field test metering used to check power system meter calibration must be more accurate than the instrument being tested.
- C. Accuracy of metering in test equipment shall be appropriate for the test being performed. Wave shape and frequency of test equipment output waveforms shall be appropriate for the test and the tested equipment.

#### 1.8 TEST INSTRUMENT CALIBRATION

- A. Testing organization shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.
- B. The firm providing calibration service shall maintain up to date instrument calibration instructions and procedures for each test instrument calibrated.
- C. The accuracy shall be directly traceable to the National Institute of Standards and Technology (NIST).
- D. Instruments shall be calibrated in accordance with the following frequency schedule:
  - 1. Field instruments: Analog, 6 months maximum. Digital, 12 months maximum.

2. Laboratory instruments: 12 months maximum.
  3. Leased specialty equipment: 12 months maximum.
- E. Dated calibration labels shall be visible on all test equipment.
- F. Records, which show date and results of instruments calibrated or tested, must be kept up to date.
- G. Calibrating standard shall be of better accuracy than that of the instrument tested.

#### 1.9 ACTION SUBMITTALS

- A. General: Notify the Engineer in writing two weeks prior to all scheduled testing to allow time for Engineer to schedule witnessing of testing, where elected by Engineer.
- B. Testing Procedures: Submit four physical copies or an electronic PDF of all proposed testing procedures to the Engineer for review at least 30 days prior to conducting any testing on the project.
- C. Calibration List: Submit four physical copies or an electronic PDF listing all testing devices to be used for the project to the Engineer for approval. Listing shall include documentation that the devices are properly calibrated.
- D. Reporting Forms: Submit four physical copies or an electronic PDF of all proposed forms to be used in recording testing data and results to the Engineer for review at least 30 days prior to conducting any testing on the project.
- E. Test Data and Results: Submit four physical copies or an electronic PDF of complete data and certified test results for each test performed, including, but not limited to:
1. Test performed.
  2. Test procedure.
  3. System and area tested.
  4. Date(s) and time(s) of test.
  5. Weather conditions.
  6. Test criteria.
  7. Test results.
  8. Additional pertinent information.

#### 1.10 INFORMATIONAL SUBMITTALS

- A. Operational Certification: Submit four certified copies of an operational certification which documents that all equipment and systems have been fully tested to verify proper operation in accordance with the design shown in the Contract documents and manufacturer's recommendations.
- B. Certification: Certifications stating that submitted test data and results are true and correct shall be provided for all submittals under this section. Certification shall be executed by an authorized officer if the Contractor is a corporation, by a partner if the Contractor is a partnership, by the owner if the Contractor is a sole proprietorship or by the authorized representative if the Contractor is a joint venture.

- C. Test Log: The Contractor shall maintain a test log at the site to document the results of all successful and unsuccessful testing and balancing as it is performed. This log shall be available for review by the Engineer and a copy of the log shall be submitted to the Engineer prior to the Substantial Completion inspection. A space shall be provided on the test log signoff by the Engineer or Owners representative.

#### 1.11 CLOSEOUT SUBMITTALS

- A. Submit a comprehensive final test report after all testing has been completed and before final acceptance of the project.
- B. The test report shall include the following:
  - 1. Summary of project.
  - 2. Description of equipment tested.
  - 3. Description of tests.
  - 4. Test data.
  - 5. Analysis and recommendations.
- C. Test data records shall include the following minimum requirements:
  - 1. Identification of the testing organization.
  - 2. Equipment identification.
  - 3. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
  - 4. Date of inspections, tests, maintenance, and/or calibrations.
  - 5. Identification of the testing technician.
  - 6. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
  - 7. Indication of expected results when calibrations are to be performed.
  - 8. Indication of “as-found” and “as-left” results, as applicable.
  - 9. Sufficient spaces to allow all results and comments to be indicated.
- D. The testing organization shall furnish a copy or copies of the complete report to the owner as specified in the acceptance testing contract.

#### 1.12 TESTING FORMS

- A. The Contractor is responsible for providing all required testing forms. For convenience, the following test forms have been included at the end of this Section:
  - 1. Electrical System Test Report
  - 2. Electrical Ground Rod Test Report
  - 3. Motor Data and Test Report.
  - 4. Instrument Test Report.

### **PART 2 - PRODUCTS**

#### 2.1 GENERAL:

- A. Provide all materials and test equipment required for testing of specified electrical systems, including re-testing until acceptable results are obtained.

## 2.2 PRODUCTS:

- A. Tested products which fail to provide acceptable test results shall be repaired or replaced with suitable materials as required to obtain acceptable results.

## PART 3 - EXECUTION

### 3.1 TESTING

- A. General: Tests shall be conducted during construction as specified by these Specifications and as required by authorities having jurisdiction.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Scope:
  - 1. The Contractor shall provide all material, equipment, labor and technical supervision to perform tests and inspections as specified herein.
  - 2. It is the intent of these tests to ensure that all electrical equipment is operational within the industry and manufacturer's tolerances and is installed in accordance with the Contract Documents.
  - 3. The tests and inspections shall determine the suitability of the system for energization.
  - 4. If the test results indicate corrective measures are required, the Contractor shall undertake all such corrective measures. No additional compensation will be paid for corrective measures.

### 3.2 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

- A. Perform grounding tests and inspections before backfilling or pouring of concrete.
- B. Tests and Inspections:
  - 1. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  - 3. Tests completed grounding system at service disconnect enclosure grounding terminal, at ground test wells and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  - 4. Prepare dimensioned drawings, locating each test well, ground rod and ground-rod assembly., and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations

of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
  - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 Ohms.
  - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 Ohms.
  - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 Ohms.
  - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 Ohms.
  - 5. Substations and Pad-Mounted Equipment: 5 Ohms.
  - 6. Manhole Grounds: 10 Ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify the Engineer promptly and include recommendations to reduce ground resistance.

### 3.3 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

- A. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test state in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
    - a. Visual and Mechanical Inspection:
      - 1) Inspect physical and mechanical condition.
      - 2) Inspect anchorage, alignment and grounding.
      - 3) Verify that resilient mounts are free and that any shipping brackets have been removed.
      - 4) Verify the unit is clean.
      - 5) Perform specific inspections and mechanical tests recommended by manufacturer.
      - 6) Verify that as-left tap connections are as specified.
      - 7) Verify the presence of surge arresters and that their ratings are as specified.
    - b. Electrical Tests:
      - 1) Measure resistance at each winding, tap and bolted connection.
      - 2) Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index. The value of the index shall not be less than 1.0.
      - 3) Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.



- 4) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
3. Large (Larger than 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
  - a. Visual and Mechanical Inspection:
    - 1) Inspect physical and mechanical condition.
    - 2) Inspect anchorage, alignment and grounding.
    - 3) Verify that resilient mounts are free and that any shipping brackets have been removed.
    - 4) Verify the unit is clean.
    - 5) Perform specific inspections and mechanical tests recommended by manufacturer.
    - 6) Verify that as-left tap connections are as specified.
    - 7) Verify the presence of surge arresters and that their ratings are as specified.
  - b. Electrical Tests:
    - 1) Measure resist at each winding, tap and bolted connection.
    - 2) Perform insulation-resistance tests winding-to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index. The value of the index shall not be less than 1.0.
    - 3) Perform power-factor or dissipation-factor tests on all windings.
    - 4) Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
    - 5) Perform an excitation-current test on each phase.
    - 6) Perform an applied voltage test on all high- and low-voltage windings to ground. See IEEE C57.12.91, Sections 10.2 and 10.9.
    - 7) Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
4. Remove and replace units that do not pass tests or inspections and retest as specified above.
5. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
  - a. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
  - b. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
  - c. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
6. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

**B. Visual and Mechanical Inspection:**

1. Compare equipment nameplate data with drawings and specifications.
2. Inspect physical and mechanical condition.
3. Inspect anchorage, alignment, and grounding.

4. Verify that resilient mounts are free and that any shipping brackets have been removed.
  5. Verify the unit is clean.
  6. Inspect bolted electrical connections for high resistance using one of the following methods:
    - a. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or Table 100.12.
- C. Electrical Tests:
1. Perform insulation-resistance tests winding to winding and each winding to ground with test voltage in accordance with Table 100.5. Calculate dielectric absorption ratio or polarization index.

### 3.4 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

- A. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors feeding the following critical equipment and services for compliance with requirements:
1. All 480V power feeders scheduled in the Conduit & Wire Schedule.
  2. Service feeder and pump feeder power cabling.
  3. Motor feeders.
- B. Perform each of the following visual and electrical tests:
1. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
  2. Test bolted connections for high resistance using one of the following.
    - a. A low-resistance ohmmeter.
    - b. Calibrated torque wrench.
    - c. Thermographic survey.
  3. Inspect compression-applied connectors for correct cable match and indentation.
  4. Inspect for correct identification.
  5. Inspect cable jacket and condition.
  6. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.
  7. Continuity test on each conductor and cable.
  8. Uniform resistance of parallel conductors.
- C. Initial Infrared Scanning: After Substantial Completion, but before Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
1. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  2. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

- D. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
- E. Perform voltage, current and resistance tests as required to complete the Electrical System Test Report form included in this specification section. Test reports must be submitted to the Engineer prior to start up. The Contractor shall inform the Engineer when testing is taking place a minimum of 5 days in advance. Testing shall not take place unless the Engineer or other Owner representative is present to witness the testing.
- F. Cables will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports to record the following:
  - 1. Procedures used.
  - 2. Results that comply with requirements.
  - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- H. Remove and replace malfunctioning wires and cables and retest and specified above.
- I. Test Values:
  - 1. Compare bolted connection resistances to values of similar connections.
  - 2. Bolt-torque levels should be in accordance with Table 100.12 unless otherwise specified by the manufacturer.
  - 3. Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
  - 4. Insulation-resistance values should not be less than 50 megohms.
  - 5. Investigate deviations in resistance between parallel conductors.

### 3.5 CONTROL-VOLTAGE ELECTRICAL POWER CABLES

- A. Tests and Inspections:
  - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments, and inspect cabling connections to confirm compliance with TIA-568-C.1.
  - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
  - 3. Test cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
    - a. Test instruments shall meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.

- C. Prepare test and inspection reports.

### 3.6 CABLE TRAYS FOR ELECTRICAL SYSTEMS

- A. Tests and inspections:
  - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
  - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations and thermal expansion and contraction conditions, which may cause or have caused damage.
  - 3. Verify that the number, size and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
  - 4. Verify that there are no intruding items, such as pipes, hangers or other equipment, in the cable tray.
  - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
  - 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
  - 7. Check for improperly sized or installed bonding jumpers,
  - 8. Check for missing, incorrect or damaged bolts, bolt heads or nuts. When found, replace with specified hardware.
  - 9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 Ohm.
- B. Prepare test and inspection reports.

### 3.7 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

- A. Tests and Inspections:
  - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank and utility structures.
  - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity, adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch long mandrel equal to duct size minus 1/4-inch. If obstructions are indicated, remove obstructions and retest.
  - 3. Clean conduits by drawing a brush with stiff bristles and a swab through each duct and conduit to make certain that no foreign materials are left in the conduit. Cleaning and mandrel operations may be performed simultaneously.
  - 4. Test manhole and handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in paragraph 3.2 of this Section.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

### 3.8 SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

- A. Tests and Inspections:
  - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  - 2. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless post connection testing has been approved), and with at least seven days' advance notice.
  - 3. Obtain Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  - 4. Test at least four of each type and size of installed anchors and fasteners selected by Engineer.
  - 5. Test to 90 percent of rated proof load of device.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.9 MOTORS

- A. Tests and Inspections:
  - 1. The Contractor shall simulate all motor alarm and shutdown conditions to test that the motor control is operating correctly. These tests shall be witnessed and verified by the Engineer.
  - 2. The Contractor shall perform voltage, current and resistance tests as required to complete the Motor Test Report form included herein. The Contractor shall inform the Engineer a minimum of 3 days in advance of testing and shall only perform tests with the Engineer or Owners representative present.
    - a. Voltage, current and circuit and winding resistance readings shall be taken with a volt-ohm meter.
    - b. Insulation resistance readings shall be taken with a 500V megger for 30 seconds with the circuit conductors connected to the motor.
- B. Test reports must be submitted to the Engineer prior to final acceptance by the Owner.
- C. If the test results indicate corrective measures are required, the Contractor shall undertake all such corrective measures until the electrical system is accepted by the Engineer. No additional compensation will be paid for corrective measures.

### 3.10 ELECTRIC ACTUATORS

- A. Tests and Inspections:
  - 1. The Contractor shall perform voltage, current and resistance tests as required to complete the Motor Test Report. The Contractor shall inform the Engineer a minimum of 3 days in advance of testing and shall only perform tests with the Engineer or Owner's representative present.
- B. Test reports must be submitted to the Engineer prior to final acceptance by the Owner.

- C. If the test results indicate corrective measures are required, the Contractor shall undertake all such corrective measures until the electrical system is accepted by the Engineer. No additional compensation will be paid for corrective measures.

### 3.11 PANELBOARDS

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Do not perform optional tests. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.12 MOTOR-CONTROL CENTERS

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Factory Acceptance Testing:
  - 1. The motor control center shall be tested in the CSI's shop along with the Control System per the requirements in this section and 16928. Operation of the motor control center shall be tested in the shop by the Control System Integrator. The

testing shall include, but not be limited to, operation of all input and output (I/O) points, control devices and motor controllers 24 hours per day for a continuous period of at least one (1) week.

- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder and control circuit.
  - 2. Test continuity of each circuit.
- D. Tests and Inspections:
  - 1. Inspect controllers, wiring, components, connections and equipment installation. Test and adjust controllers, components and equipment as required.
  - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 3. Test insulation resistance for each enclosed controller, component, connecting supply, feeder and control circuit.
  - 4. Test continuity of each circuit.
  - 5. Verify that voltages at controller locations are within 10 percent of motor nameplated rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
  - 6. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  - 7. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 8. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 9. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multipole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multipole enclosed controller 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Submit calibration record for device.
  - 10. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
  - 11. Mark up a set of manufacturer's drawings with all field modifications incorporated during construction and return to manufacturer for inclusion in Record Drawings.
- E. MCC components will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

### 3.13 WIRING DEVICES

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections:
  - 1. In healthcare facilities, prepare reports that comply with NFPA 99.
  - 2. Test Instruments: Use instruments that comply with UL 1436.
  - 3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for Receptacles:
  - 1. Line Voltage: Acceptable range is 105 to 132 V.
  - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
  - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
  - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- E. Test straight-blade hospital-grade outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz.
- F. Wiring device will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

### 3.14 ENCLOSED SWITCHES AND CIRCUIT BREAKERS

- A. Tests and Inspections for Switches:
  - 1. Visual and Mechanical Inspection:
    - a. Inspect physical and mechanical condition.
    - b. Inspect anchorage, alignment, grounding and clearances.
    - c. Verify that the unit is clean.
    - d. Verify blade alignment, blade penetration, travel stops and mechanical operation.
    - e. Verify that fuse sizes and types match the Specifications and Drawings.
    - f. Verify that each fuse has adequate mechanical support and contact integrity.
    - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
      - 1) Use a low-resistance ohmmeter.
      - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from



those of similar bolted connections by more than 50 percent of the lowest value.

- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

- a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.

- i. Verify correct phase barrier installation.

- j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compared bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

- b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

- c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

- d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.

- e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

B. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data is as described in the Specifications and shown on the Drawings.

- b. Inspect physical and mechanical condition.

- c. Inspect anchorage, alignment, grounding, and clearances.

- d. Verify that the unit is clean.

- e. Operate the circuit breaker to ensure smooth operation.

- f. Inspect bolted electrical connections for high resistance using one of the two following methods:

- 1) Use a low-resistance ohmmeter.

- a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from

- those of similar bolted connections by more than 50 percent of the lowest value.
- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
    - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
  - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
  - h. Perform adjustments for final protective device settings in accordance with the coordination study.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
  - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
  - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
  - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
  - e. Determine the following by primary current injection:
    - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
    - 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.

- f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
    - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
    - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
    - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
  - 3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 4. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.
- 1. Test procedures used.
  - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
  - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

### 3.15 MANUAL AND MAGNETIC MOTOR CONTROLLERS

- A. Tests and Inspections:
- 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
  - 2. Visual and Mechanical Inspection:
    - a. Compare equipment nameplate data with drawings and specifications.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment and grounding.
    - d. Verify the unit is clean.
    - e. Inspect contactors:
      - 1) Verify mechanical operation.

- 2) Verify contact gap, wipe, alignment and pressure are according to manufacturer's published data.
- f. Motor-Running Protection:
  - 1) Verify overload element rating is correct for its application.
  - 2) If motor-running protection is provided by fuses, verify correct fuse rating.
- g. Inspect bolted electrical connections for high resistance using one of the two following methods.
  - 1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
3. Electrical Tests:
  - a. For the contactor and circuit breaker, perform insulation and resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
  - b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
  - c. Test motor protection devices according to manufacturer's published data.
  - d. Test circuit breakers as follows:
    - 1) Operate the circuit breaker to ensure smooth operation.
    - 2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.
  - e. Perform operational tests by initiating control devices.
4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.
  - a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
  - b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
  - c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
  - d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:
    - 1) Description of equipment to be tested.
    - 2) Discrepancies.

- 3) Temperature difference between the area of concern and the reference area.
- 4) Probable cause of temperature difference.
- 5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
- 6) Load conditions at time of inspection.
- 7) Photographs and thermograms of the deficient area.
- 8) Recommended action.
- e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
- f. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.
5. System Function Tests:
  - a. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.
    - 1) Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
    - 2) Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
    - 3) Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controller will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.16 SOFT-START MOTOR CONTROLLERS

- A. Tests and Inspections:
  1. Comply with provisions of NFPA 70B, Chapter "Testing and Test Methods."
  2. Visual and Mechanical Inspection:
    - a. Compare equipment nameplate data with Drawings and the Specifications.
    - b. Inspect physical and mechanical condition.
    - c. Inspect anchorage, alignment, and grounding.
    - d. Verify that the unit is clean.
    - e. Ensure that vent path openings are free from debris and that heat-transfer surfaces are clean.
    - f. Verify correct connections of circuit boards, wiring, disconnects, and ribbon cables.
    - g. Inspect Contactors:
      - 1) Verify mechanical operation.

- 2) Verify that contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
- h. Motor-Running Protection:
  - 1) Verify that motor FLA is at, or under, the controller current rating.
  - 2) Verify that overload element setting is correct for its application.
  - 3) Apply minimum- and maximum-speed set points. Verify that set points are within limitations of the load coupled to the motor.
  - 4) If motor-running protection is provided by fuses, verify correct fuse rating.
- i. Inspect bolted electrical connections for high resistance using one of the following two methods:
  - 1) Use a low-resistance ohmmeter. Compare bolted-connection-resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
  - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS, Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS, Table 100.12.
- j. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
3. Electrical Tests:
  - a. For the contactor and circuit breaker, perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS, Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than this table or manufacturer's written instructions shall be investigated and corrected.
  - b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
  - c. Test motor protection devices according to manufacturer's published data.
  - d. Test circuit breakers as follows:
    - 1) Operate the circuit breaker to ensure smooth operation.
    - 2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.
  - e. Test the electronic motor overload relay elements by injecting primary current through the overload circuit and monitoring trip time of the overload element.
  - f. Test the following parameters according to NETA relay calibration procedures, or as recommended by manufacturer:
    - 1) ANSI No. 49R, Overtemperature Protection:
      - a) Determine time delay at 300 percent of setting.
      - b) Determine a second point on the operating curve.
      - c) The pickup determination in first subparagraph below is normally considered an optional field test.
      - d) Determine pickup.
    - 2) ANSI No. 47, Input Phase Loss and Reversed Phases Protection:

- a) Determine positive sequence voltage to close the NO contact.
    - b) Determine positive sequence voltage to open the NC contact (undervoltage trip).
    - c) Verify negative sequence trip.
    - d) Determine time delay to close the NO contact with sudden application of 120 percent of pickup.
    - e) Determine time delay to close the NC contact on removal of voltage when previously set to rated system voltage.
  - 3) ANSI No. 81, Overfrequency Protection:
    - a) Verify frequency set points.
    - b) Determine time delay.
    - c) Determine undervoltage cutoff.
  - 4) Fault Alarm Outputs: Verify that each relay contact performs its intended function in the control scheme including breaker trip tests, close inhibit tests, lockout tests, and alarm functions.
- g. Perform operational tests by initiating control devices.
- 4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.
  - a. Comply with recommendations of NFPA 70B, Chapter "Testing and Test Methods," Article "Infrared Inspection."
  - b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
  - c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
  - d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:
    - 1) Description of equipment to be tested.
    - 2) Discrepancies.
    - 3) Temperature difference between the area of concern and the reference area.
    - 4) Probable cause of temperature difference.
    - 5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
    - 6) Identify load conditions at time of inspection.
    - 7) Provide photographs and thermograms of the deficient area.
    - 8) Recommended action.
  - e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1 deg C at 30 deg C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
  - f. Act on inspection results, recommended action, and considering recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.
- 5. System Function Tests:
  - a. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field

quality-control tests have been completed and all components have passed specified tests.

- 1) Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
- 2) Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
- 3) Verify the correct operation of sensing devices, alarms, and indicating devices.

B. Motor controllers will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.17 VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Acceptance Testing Preparation:

1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Inspect VFC, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
3. Test continuity of each circuit.
4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Engineer before starting the motor(s).
5. Test each motor for proper phase rotation.
6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:
  - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFC. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFC 11 months after date of Substantial Completion.
  - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.



10. Test for the following parameters:
    - a. Input phase loss protection
    - b. Input overvoltage protection
    - c. Output phase rotation
    - d. Over temperature protection
    - e. DC overvoltage protection
    - f. Over frequency protection
    - g. Drive overload protection
    - h. Fault alarm outputs
  11. Perform startup of drive in accordance with manufacturer's published data. Calibrate drive to the system's minimum and maximum speed control signals.
  12. Perform operational tests by initiating control devices.
    - a. Slowly vary drive speed between minimum and maximum. Observe motor and load for unusual noise or vibration.
    - b. Verify operation of drive from remote start/stop and speed control signals.
- C. VFCs will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

### 3.18 SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

- A. Tests and Inspections:
1. Compare equipment nameplate data for compliance with the Contract Documents.
  2. Inspect anchorage, alignment, grounding and clearances.
  3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. SPDs that do not pass tests and inspections will be considered defective.
- C. Prepare test and inspection reports.

### 3.19 LUMINAIRES

- A. Tests and Inspections:
1. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
  2. Inspect lighting poles and standards for burs, nicks, dents, scratches and other damage. Poles or standards determined to be damaged shall be repaired or replaced as required by the Engineer.
  3. Operational Test: After installing luminaires, switches and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  4. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
  5. Test the following controls for proper operation:
    - a. Photoelectrical Controls

- b. Occupancy/Motion Sensing Controls
- c. Timeclocks

B. Prepare test and inspection reports.

### 3.20 LIGHTING POLES AND STANDARDS

- A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:
- 1. Inspect poles for nicks, mars, dents, scratches, and other damage.
  - 2. System function tests.

### 3.21 LOW-VOLTAGE SWITCHGEAR

- A. Tests and Inspections:
- 1. Acceptance Testing:
    - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder and control circuit. Open control and metering circuits within the switchboard and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
    - b. Test continuity of each circuit.
  - 2. Test ground-fault protection of equipment for service equipment per NFPA 70.
  - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 4. Correct malfunctioning units on-site where possible and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 5. Perform the following infrared scan tests and inspections and prepare reports.
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switchboard. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switchboard 11 months after date of Substantial Completion.
    - c. Instruments and Equipment:
      - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 6. Test and adjust controls, remote monitoring and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Switchgear will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

### 3.22 METERING DEVICES

- A. Visual and Mechanical Inspection:

1. Inspect physical and mechanical condition.
  2. Verify tightness of electrical connections.
  3. Inspect cover gasket, cover glass, condition of spiral spring, disk clearance, contacts, and case-shorting contacts, as applicable.
  4. Verify the unit is clean.
  5. Verify freedom of movement, end play, and alignment of rotating disk(s).
- B. Electrical Tests:
1. Verify accuracy of meters at all cardinal points.
  2. Calibrate meters in accordance with manufacturer's published data.
  3. Verify that current transformer and voltage transformer secondary circuits are intact.

### 3.23 GROUND-FAULT PROTECTION SYSTEMS

- A. Visual and Mechanical Inspection:
1. Inspect the components for damage and errors in polarity or conductor routing.
  2. Set pickup and time-delay settings in accordance with the settings provided in the Contractor's coordination study. Record appropriate operation and test sequences as required by NFPA 70 National Electrical Code Article 230.95.
- B. Electrical Tests:
1. Measure the system neutral-to-ground insulation resistance with the neutral disconnect link temporarily removed. Replace neutral disconnect link after testing.
  2. Perform the following pickup tests using primary injection:
    - a. Verify that the trip unit does not operate at 90 percent of the pickup setting.
    - b. Verify pickup is less than 125 percent of setting or 1200 amperes, whichever is smaller.
  3. Measure time delay of the relay at 150 percent or greater of pickup.
- C. Test Values:
1. System neutral-to-ground insulation shall be a minimum of 1.0 megohm.
  2. Relay timing shall be in accordance with manufacturer's specifications but must be no longer than one second at 3000 amperes.

### 3.24 ROTATING MACHINERY AND AC MOTORS

- A. Visual and Mechanical Inspection:
1. Compare equipment nameplate data with drawings and specifications.
  2. Inspect physical and mechanical condition.
  3. Inspect anchorage, alignment, and grounding.
  4. Inspect air baffles, filter media, cooling fans, slip rings, brushes, and brush rigging.
  5. Verify the unit is clean.
  6. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or Table 100.12.
  7. Verify correct application of appropriate lubrication and lubrication systems.

8. Verify the absence of unusual mechanical or electrical noise or signs of overheating during initial test run.
- B. Electrical Tests – AC Induction Motors:
1. Perform resistance measurements through bolted connections with a low-resistance ohmmeter.
  2. Perform insulation-resistance tests in accordance with ANSI/IEEE 43.
    - a. Motors 200 horsepower and less: Test duration shall be for one minute. Calculate the dielectric-absorption ratio.
  3. Perform stator resistance test phase-to-phase.
  4. Verify operation of the space heater, if applicable.
  5. Perform a rotation test to insure correct shaft direction.
  6. Measure running current and evaluate relative to load conditions and nameplate full-load amperes.
- C. Test Values:
1. Bolt-torque levels should be in accordance with Table 100.12 unless otherwise specified by manufacturer.
  2. Insulation-resistance test results shall be in accordance with values listed in Table 100.1.
  3. Stator resistances should be compared to manufacturer's published data.
  4. Pedestal bearing insulation resistance shall not be less than 1.0 megohm at 500 volts dc.
  5. Motor space heater test results should match nameplate rating.
  6. Machine rotation should match required rotation of connected load.
  7. Running phase-to-phase voltages should be within 1.0 percent. Running currents shall be balanced and proportional to load condition and nameplate data.
  8. The measured resistance values of motor-field winding, exciter-stator windings, exciter-rotor windings, and field-discharge resistors shall be compared to manufacturer's published data.

### 3.25 LOW-VOLTAGE SURGE PROTECTION DEVICES

- A. Visual and Mechanical Inspection:
1. Compare equipment nameplate data with drawings and specifications.
  2. Inspect physical and mechanical condition.
  3. Inspect anchorage, alignment, grounding, and clearances.
  4. Verify the arresters are clean.
  5. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or Table 100.12.
  6. Verify that the ground lead on each device is individually attached to a ground bus or ground electrode.
- B. Electrical Tests:
1. Perform insulation-resistance tests. Use manufacturer's recommended values.
  2. Test grounding connection in accordance with paragraph 3.2.
- C. Test Values:
1. Compare bolted connection resistances to values of similar connections.

2. Bolt-torque levels should be in accordance with Table 100.12 unless otherwise specified by manufacturer.
3. Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from similar connections by more than 50 percent of the lowest value.
4. Insulation-resistance values should be a minimum of 25 megohms.
5. Resistance between the arrester ground terminal and the ground system should be less than 0.5 ohm.

### 3.26 FIBER-OPTIC CABLES

- A. Visual and Mechanical Inspection:
  1. Compare cable, connector, and splice data with drawings and specifications.
  2. Inspect cable and connections for physical and mechanical damage.
  3. Verify that all connectors and splices are correctly installed.
- B. Electrical Tests:
  1. Perform cable length measurement, fiber fracture inspection, and construction defect inspection using an optical time domain reflectometer.
  2. Perform connector and splice integrity test using an optical time domain reflectometer.
  3. Perform cable attenuation loss measurement with an optical power loss test set.
  4. Perform connector and splice attenuation loss measurement from both ends of the optical cable with an optical power loss test set.
- C. Test Values:
  1. The optical time domain reflectometer signal should be analyzed for excessive connection, splice, or cable backscatter by viewing the reflected power/distance graph.
  2. Attenuation loss measurement shall be expressed in dB/km. Losses shall be within the manufacturer's recommendations when no local site specifications are available.

### 3.27 ELECTRICAL POWER MONITORING AND CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  2. Power Monitoring and Control System Tests.
    - a. Test Analog Signals:
      - 1) Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
      - 2) Check analog current signals using a precision current meter at zero, 50, and 100 percent.
      - 3) Check resistance signals for temperature sensors at zero, 50, and 100 percent of operating span using a precision-resistant source.
    - b. Test Digital Signals:
      - 1) Check digital signals using a jumper wire.

- 2) Check digital signals using an ohmmeter to test for contact making or breaking.
- c. I/O Control Loop Tests:
  - 1) Test every I/O point to verify that safety and operating control set points are as indicated and as required to operate controlled system safely and at optimum performance.
  - 2) Test every I/O point throughout its full operating range.
  - 3) Test every control loop to verify that operation is stable and accurate.
  - 4) Adjust control loop proportional, integral, and derivative settings to achieve optimum performance while complying with performance requirements indicated. Document testing of each control loop's precision and stability via trend logs.
  - 5) Test and adjust every control loop for proper operation according to sequence of operation.
  - 6) Test software and hardware interlocks for proper operation.
  - 7) Operate each analog point at the following:
    - a) Upper quarter of range.
    - b) Lower quarter of range.
    - c) At midpoint of range.
  - 8) Exercise each binary point.
  - 9) For every I/O point in the system, read and record each value at workstation, at controller, and at field instrument simultaneously. Value displayed at workstation and at field instrument shall match.
  - 10) Prepare and submit a report documenting results for each I/O point in the system, and include in each I/O point a description of corrective measures and adjustments made to achieve desired results.

B. Wiring and cabling will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

### 3.28 HARMONIC MITIGATION

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies and equipment installations, including connections and to assist in testing.

C. Tests and Inspections:

1. Harmonic compliance shall be verified with onsite field measurements of both the voltage and current harmonic distortion at the service disconnect with and without the associated motors/equipment operating.

D. Harmonic mitigation equipment will be considered defective if it does not pass tests and inspections.

### 3.29 SYSTEM FUNCTION TESTS

- A. It is the purpose of system function tests to prove the correct interaction of all sensing, processing, and action devices. Perform system function tests upon the completion of acceptance testing required on specified equipment.
- B. Develop test parameters and perform tests for the purpose of evaluating performance of all manufacturer's published data.
- C. Verify the correct operation of all interlock safety devices for fail-safe functions in addition to design function.
- D. Verify the correct operation of all sensing devices, alarms, and indicating devices.

**END OF SECTION**

## MOTOR DATA AND TEST REPORT

EQUIPMENT NAME AND NUMBER: \_\_\_\_\_

EQUIPMENT SPECIFICATION SECTION: \_\_\_\_\_

MOTOR STARTER LOCATION \_\_\_\_\_

CONTRACTORS REPRESENTATIVE \_\_\_\_\_ Date \_\_\_\_\_

MOTOR NAMEPLATE DATA

MFR Name/Model No. \_\_\_\_\_

Voltage/Phase/HP \_\_\_\_\_

FLA/LRA \_\_\_\_\_

Service Factor \_\_\_\_\_

Efficiency Index (or percent) \_\_\_\_\_

NEMA Design \_\_\_\_\_

Code Letter \_\_\_\_\_

Insulation Type \_\_\_\_\_

Temperature Rise \_\_\_\_\_

Ambient Temperature \_\_\_\_\_

RPM \_\_\_\_\_

Enclosure \_\_\_\_\_

Thermal Trip Setting \_\_\_\_\_

Space HTR: Watts/Volts \_\_\_\_\_

Other Data \_\_\_\_\_

MOTOR STARTER INFORMATION

Manufacturer/Type \_\_\_\_\_

Overload Heater No \_\_\_\_\_

* RECORDED FULL LOAD DATA	VOLTS	A-G	_____	B-G	_____	C-G	_____
FULL LOAD OPERATING VOLTAGE	VOLTS	A-B	_____	B-C	_____	C-A	_____
FULL LOAD OPERATING CURRENT	AMPS	A	_____	B	_____	C	_____
INSULATION RESISTANCE	MEGOHMS	A-G	_____	B-G	_____	C-G	_____
MOTOR CIRCUIT RESISTANCE	OHMS	A-B	_____	B-C	_____	C-A	_____

\*VOLTAGE & CURRENT READINGS SHALL BE TAKEN AT THE CLOSEST ACCESSIBLE POINT TO THE LOAD



### TRANSMITTER CALIBRATION / TEST DATA FORM

Tag. No. and/or Description: \_\_\_\_\_ Serial No. \_\_\_\_\_

Make and Model No.: \_\_\_\_\_

Associated Panel: \_\_\_\_\_

Type of testing equipment used: \_\_\_\_\_

Input: \_\_\_\_\_

Output: \_\_\_\_\_

Range: \_\_\_\_\_ Scale: \_\_\_\_\_

Calibrated Value (flow/pressure/turbidity etc.) at 4mA \_\_\_\_\_

Calibrated Value (flow/pressure/turbidity etc.) at 20mA \_\_\_\_\_

Simulate process variable (flow, pressure, turbidity, etc.) and measure output with appropriate meter.

Related value is (example: the level associated with the pressure).

<u>% Range</u>	<u>Input (engr. units)</u>	<u>Related value</u>	<u>Expected Output</u>	<u>Actual Output</u>
0	_____	_____	_____	_____
25	_____	_____	_____	_____
50	_____	_____	_____	_____
75	_____	_____	_____	_____
100	_____	_____	_____	_____

COMMENTS:

TESTED BY \_\_\_\_\_ DATE: \_\_\_\_\_

OWNERS REPRESENTATIVE \_\_\_\_\_ DATE: \_\_\_\_\_

# ELECTRICAL SYSTEM TEST REPORT – 600V CABLE

## ELECTRICAL SYSTEM

### DESCRIPTION DATA

#### SERVICE DESCRIPTION:

Nominal Voltage, Phase To Phase

Phase To Neutral – Single Or Three Phases-

Number Of Conductors

#### SERVICE CONDUCTORS:

Phase Size And Insulation Type

Neutral Size And Insulation Type

Ground Size And Insulation Type

#### SERVICE DISCONNECT DESCRIPTION:

Circuit Breaker Or Disconnect Switch

Size (amps)

Fuse (amps)

### MEASURED CONDITIONS

### DATA

Operating Load Voltage

Volts

Vab

Vbc

Vca

Van

Vbn

Vcn

Operating Load Feeder Current

Amps

Ia

Ib

Ic

a-b

b-c

c-a

Conductor Insulation Mega ohms

Mega  $\Omega$

a-g

b-g

c-g

Resistance - record the indicated measurement for each of the following circuits:

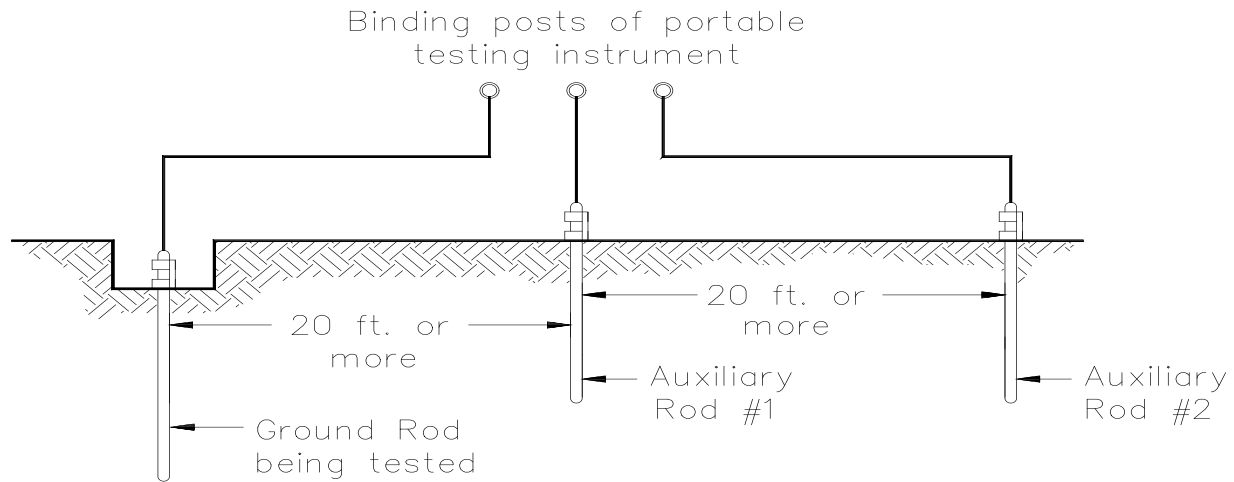
Service Feeder

Pump Feeders

Motor Feeders

480V Feeders

## ELECTRICAL GROUND ROD TEST REPORT



## GROUND ROD RESISTANCE TESTING

### PROCEDURE:

To measure ground resistance, two additional temporary grounds, consisting of short rods 2 or 3 feet long, shall be driven in the ground at least 20 feet away from the rod being tested. A direct-reading ground resistance tester shall then be connected to the three ground rods by means of insulated leads. The battery operated ground resistance tester reads the resistance of the ground rod being tested directly in ohms. The ground rod location / designation and its measured ohm value shall be recorded in chart below.

GROUND ROD LOCATION / DESIGNATION	OHM VALUE
1.	*
2.	*
3.	*
COMPOSITE GROUND	*

\*Ohm value of a single ground rod shall not exceed 25 Ohms. If additional ground rod(s) are added, the "composite" ground electrode shall have a maximum acceptable reading of 15 Ohms which shall be recorded in chart above.

## **SECTION 16851**

### **HEATING VENTILATION AND AIR CONDITIONING ELECTRICAL COORDINATION**

#### **PART 1 - GENERAL**

##### **1.1 DESCRIPTION OF WORK**

- A. This section covers the electrical coordination and installation of all mechanical equipment: heaters, fans, thermostats, and dehumidifiers.

##### **1.2 STANDARDS AND CODES**

- A. Comply with all provisions of the following standards, latest edition except where otherwise indicated:
  - 1. National Electrical Code
  - 2. UL Requirements
  - 3. NEMA Standards

##### **1.3 COORDINATION**

- A. The Contractor is fully responsible for coordination of mechanical equipment, fans, louvers, heaters, motors, starters, etc. and the electrical power and control requirements. Provided in this section and other sections of the specifications and drawings.
- B. The Contractor shall provide power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.
- C. The Contractor shall verify as a minimum:
  - 1. Correct voltage, phase and frequency
  - 2. Correct motor starter type
  - 3. Proper coordination with the controls and control system Integrator.
- D. The Contractor shall provide all necessary control wiring and components for any special requirements from an equipment manufacturer.
- E. Any discrepancies between the electrical and mechanical equipment shall be brought to the immediate attention of the Engineer.

##### **1.4 ACTION SUBMITTALS**

- A. Project data submitted in accordance with Section 16010 shall include but not be limited to the following:
  - 1. Catalog data showing material information and conformance with the specifications. The intended use of each item shall be indicated.
  - 2. Each piece of equipment shall be clearly identified and shall include:
    - a. All electrical data for equipment, including voltage, watts, hp, etc.
    - b. Schematics and wiring diagrams for all control and power features and requirements.

- c. Installation details and operation data.

## 1.5 CLOSEOUT SUBMITTALS

- A. The manufacturer shall prepare and assemble detailed operation and maintenance manuals in accordance with the requirements. The manuals shall include, but not be limited to the following:
  - 1. Preventative maintenance procedures
  - 2. Trouble-shooting
  - 3. Replacement of components
  - 4. System schematics
  - 5. As-built wiring diagrams of overall system
  - 6. Catalog data and complete parts list for all equipment and control devices.

## PART 2 - PRODUCTS

### 2.1 MECHANICAL EQUIPMENT

- A. Reference the Electrical / Mechanical Equipment Schedule on drawing on plan sheets.

## PART 3 - EXECUTION

### 3.1 MOUNTING

- A. Ceiling mounted heaters shall be ceiling mounted using factory mounting kit. Connections to the heater shall be with liquid-tight flexible metal conduit.
- B. Wall heaters shall be surface wall mounted with the bottom of the heater at minimum 7' - 6" above the floor. Connections to the heater shall be with liquid-tight flexible metal conduit.

### 3.2 POWER & CONTROL WIRING

- A. Contractor shall provide and install all necessary power and control wiring and raceways for installation in accordance with the manufacturer's requirements and the requirements of the contract drawings and specifications.
- B. Provide disconnects for all power circuits in accordance with NEC.
- C. Provide control wiring and raceway to thermostats and other control devices.
- D. Provide power and control wiring and raceways to motor operated louvers per the manufacturers requirements.

### 3.3 THERMOSTAT/HUMIDISTANT MOUNTING

- A. Thermostats shall be wall mounted at 60 inches above finished floor. Wiring shall be routed in 1/2 inch conduit vertically from thermostat to wall heater.

**END OF SECTION**

## **SECTION 18111**

### **DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM**

#### **PART 1 - GENERAL**

##### **1.01 RELATED DOCUMENTS**

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

##### **1.02 SUMMARY**

- A. Section Includes:
  - 1. Fire-alarm control unit.
  - 2. Manual fire-alarm boxes.
  - 3. System smoke detectors.
  - 4. Heat detectors.
  - 5. Notification appliances.
  - 6. Device guards.
  - 7. Remote annunciator.
  - 8. Addressable interface device.
  - 9. Digital alarm communicator transmitter.
- B. Related Requirements:
  - 1. Section 18153 "Conductors and Cables for Electronic Safety and Security".

##### **1.03 DEFINITIONS**

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.
- E. VESDA: Very Early Smoke-Detection Apparatus.

##### **1.04 ACTION SUBMITTALS**

- A. Product Data: For each type of product, including furnished options and accessories.
  - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
  - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
  - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
  - 2. Include plans, elevations, sections, details, and attachments to other work.
  - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations.

- Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
  - 4. Detail assembly and support requirements.
  - 5. Include voltage drop calculations for notification-appliance circuits.
  - 6. Include battery-size calculations.
  - 7. Include input/output matrix.
  - 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
  - 9. Include performance parameters and installation details for each detector.
  - 10. Include alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.
  - 11. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.
- C. General Submittal Requirements:
  - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
  - 2. Shop Drawings shall be prepared by persons with the following qualifications:
    - a. Trained and certified by manufacturer in fire-alarm system design.
    - b. NICET-certified, fire-alarm technician; Level III minimum.
- D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
  - 1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
  - 2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
  - 3. Indicate audible appliances required to produce square wave signal per NFPA 72.

#### 1.05 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section "Operation and Maintenance Data," include the following:
    - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
    - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.



- c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
- d. Riser diagram.
- e. Device addresses.
- f. Record copy of site-specific software.
- g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
  - 1) Equipment tested.
  - 2) Frequency of testing of installed components.
  - 3) Frequency of inspection of installed components.
  - 4) Requirements and recommendations related to results of maintenance.
  - 5) Manufacturer's user training manuals.
- h. Manufacturer's required maintenance related to system warranty requirements.
- i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

- 1. Software operating and upgrade manuals.
- 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
- 3. Device address list.
- 4. Printout of software application and graphic screens.

## 1.06 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
  - 2. Smoke Detectors, Fire Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.
  - 3. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
  - 4. Keys and Tools: One extra set for access to locked or tamper proofed components.
  - 5. Audible and Visual Notification Appliances: One of each type installed.
  - 6. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

## 1.07 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level II technician.

## 1.08 PROJECT CONDITIONS

- A. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

## 1.09 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
  - 1. Warranty Period: One year from date of Substantial Completion.

# PART 2 - PRODUCTS

## 2.01 SYSTEM DESCRIPTION

Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.

- A. Noncoded, UL-certified addressable system, with multiplexed signal transmission and horn/strobe evacuation.
- B. Automatic sensitivity control of certain smoke detectors.
- C. All components provided shall be listed for use with the selected system.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

## 2.02 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
  - 1. Manual stations.
  - 2. Heat detectors.
  - 3. Smoke detectors.
  - 4. Automatic sprinkler system water flow.
- B. Fire-alarm signal shall initiate the following actions:
  - 1. Continuously operate alarm notification appliances.
  - 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
  - 3. Transmit an alarm signal to the remote alarm receiving station.

4. Activate alarm communication system.
  5. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
  6. Record events in the system memory.
  7. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
  2. High- or low-air-pressure switch of a dry-pipe or preaction sprinkler system.
  3. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
  2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
  3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
  4. Loss of primary power at fire-alarm control unit.
  5. Ground or a single break in internal circuits of fire-alarm control unit.
  6. Abnormal ac voltage at fire-alarm control unit.
  7. Break in standby battery circuitry.
  8. Failure of battery charging.
  9. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.
  2. Identify specific device initiating the event at fire-alarm control unit and remote annunciators.
  3. Record the event on system printer.
  4. Transmit system status to building management system.

## 2.03 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

## 2.04 FIRE-ALARM CONTROL UNIT

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Gamewell - FCI by Honeywell.
  2. Notifier.
  3. Siemens Industry, Inc.; Fire Safety Division.
  4. Silent Knight Farenhyt by an Authorized Farenhyt Distributor
  5. SimplexGrinnell LP.

- B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
    - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
    - b. Include a real-time clock for time annotation of events on the event recorder and printer.
    - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
    - d. The FACP shall be listed for connection to a central-station signaling system service.
    - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
  2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
  3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.
- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
  2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
1. Pathway Class Designations: NFPA 72, Class B.
  2. Pathway Survivability: Level 1.
  3. Install no more than 50 addressable devices on each signaling-line circuit.
  4. Serial Interfaces:
    - a. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
- F. Smoke-Alarm Verification:
1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.

2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
  3. Record events by the system printer.
  4. Sound general alarm if the alarm is verified.
  5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- G. Notification-Appliance Circuit:
1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
  2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
  3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- H. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- I. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals shall be powered by 24-V dc source.
1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- J. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
1. Batteries: As provided by manufacturer.
- K. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

## 2.05 MANUAL FIRE-ALARM BOXES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Gamewell - FCI by Honeywell.
  2. Notifier.
  3. Siemens Industry, Inc.; Fire Safety Division.
  4. Silent Knight.
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.

1. Double-action mechanism requiring two actions to initiate an alarm, breaking-glass or plastic-rod type; with integral or attached addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
2. Station Reset: Key- or wrench-operated switch.
3. Indoor Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
4. Weatherproof Protective Shield: Factory-fabricated, clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
5. Explosion proof in classified areas.

## 2.06 SYSTEM SMOKE DETECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Gamewell - FCI by Honeywell.
  2. Notifier.
  3. Siemens Industry, Inc.; Fire Safety Division.
  4. Silent Knight.
- B. General Requirements for System Smoke Detectors:
  1. Comply with UL 268; operating at 24-V dc, nominal.
  2. Detectors shall be two-wire type.
  3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
  4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
  5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
  6. Integral Visual-Indicating Light: LED type, indicating detector has operated.
  7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
    - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 deg F per minute.
    - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be settable at fire-alarm control unit to operate at 135 deg F.
    - c. Multiple levels of detection sensitivity for each sensor.
    - d. Sensitivity levels based on time of day.
- C. Photoelectric Smoke Detectors:
  1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.

2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
  - a. Primary status.
  - b. Device type.
  - c. Present average value.
  - d. Present sensitivity selected.
  - e. Sensor range (normal, dirty, etc.).

## 2.07 HEAT DETECTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Gamewell - FCI by Honeywell.
  2. Siemens Industry, Inc.; Fire Safety Division.
  3. Silent Knight.
  4. SimplexGrinnell LP.
- B. General Requirements for Heat Detectors: Comply with UL 521.
  1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
  1. Mounting: Adapter plate for outlet box mounting.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
- D. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F.
  1. Mounting: Adapter plate for outlet box mounting.
  2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

## 2.08 NOTIFICATION APPLIANCES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. Federal Signal Corporation.
  2. Siemens Industry, Inc.; Fire Safety Division.
  3. SimplexGrinnell LP.
  4. System Sensor.
  5. Wheelock; a brand of Eaton.
  6. Honeywell.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.

1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- D. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
  1. Rated Light Output:
    - a. 15/30/75/110 cd, selectable in the field.
  2. Mounting: Wall mounted unless otherwise indicated.
  3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
  4. Flashing shall be in a temporal pattern, synchronized with other units.
  5. Strobe Leads: Factory connected to screw terminals.
  6. Mounting Faceplate: Factory finished, red.
- E. Addressable Relay Modules:
  1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
  2. Allow the control panel to switch the relay contacts on command.
  3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
  4. Listed for controlling HVAC fan motor controllers.
- F. Explosion proof in classified areas.

## 2.09 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
  1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

## 2.10 ADDRESSABLE INTERFACE DEVICE

- A. General:
  1. Include address-setting means on the module.
  2. Store an internal identifying code for control panel use to identify the module type.
  3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.



Control Module:

1. Operate notification devices.
2. Operate solenoids for use in sprinkler service.

## 2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line and dial a preset number for a remote central station. When contact is made with central station, signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.
- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
  1. Verification that both telephone lines are available.
  2. Programming device.
  3. LED display.
  4. Manual test report function and manual transmission clear indication.
  5. Communications failure with the central station or fire-alarm control unit.
- D. Digital data transmission shall include the following:
  1. Address of the alarm-initiating device.
  2. Address of the supervisory signal.
  3. Address of the trouble-initiating device.
  4. Loss of ac supply.
  5. Loss of power.
  6. Low battery.
  7. Abnormal test signal.
  8. Communication bus failure.
- E. Secondary Power: Integral rechargeable battery and automatic charger.
- F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

## 2.12 DEVICE GUARDS

- A. Description: Welded wire mesh of size and shape for the manual station, smoke detector, gong, or other device requiring protection.
  1. Factory fabricated and furnished by device manufacturer.
  2. Finish: Paint of color to match the protected device.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
  - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 EQUIPMENT INSTALLATION**

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
  - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
  - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Install wall-mounted equipment, with tops of cabinets not more than 78 inches above the finished floor.
- C. Manual Fire-Alarm Boxes:
  - 1. Install manual fire-alarm box in the normal path of egress within 60 inches of the exit doorway.
  - 2. Mount manual fire-alarm box on a background of a contrasting color.
  - 3. The operable part of manual fire-alarm box shall be between 42 inches and 48 inches above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- D. Smoke- or Heat-Detector Spacing:
  - 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.
  - 2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
  - 3. Smooth ceiling spacing shall not exceed 30 feet.
  - 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
  - 5. HVAC: Locate detectors not closer than 36 inches from air-supply diffuser or return-air opening.
  - 6. Lighting Fixtures: Locate detectors not closer than 12 inches from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.

- E. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- F. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- G. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille. Install all devices at the same height unless otherwise indicated.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling. Install all devices at the same height unless otherwise indicated.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.

### 3.03 PATHWAYS

- A. Pathways above recessed ceilings and in non-accessible locations may be routed exposed.
  - 1. Exposed pathways located less than 96 inches above the floor shall be installed in EMT.
- B. Pathways shall be installed in EMT.
- C. Exposed EMT shall be painted red enamel.

### 3.04 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section "Door Hardware." Connect hardware and devices to fire-alarm system.
  - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
  - 1. Magnetically held-open doors.
  - 2. Electronically locked doors and access gates.
  - 3. Alarm-initiating connection to activate emergency lighting control.
  - 4. Alarm-initiating connection to activate emergency shutoffs for gas and fuel supplies.
  - 5. Supervisory connections at valve supervisory switches.
  - 6. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
  - 7. Data communication circuits for connection to building management system.
  - 8. Data communication circuits for connection to mass notification system.

### 3.05 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 16153 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

### 3.06 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

### 3.07 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Visual Inspection: Conduct visual inspection prior to testing.
    - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
    - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
  - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
  - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
  - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
  - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- D. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- E. Fire-alarm system will be considered defective if it does not pass tests and inspections.

- F. Prepare test and inspection reports.
- G. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- H. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

### 3.08 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
  - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
  - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

### 3.09 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for one year.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within one year from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
  - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

### 3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

## END OF SECTION

# **APPENDIX 1**

## **GEOTECHNICAL REPORT**



February 15, 2023  
File: MO22198A

Mr. Travis Pyle, P.E.  
Great West Engineering, Inc.  
3050 N. Lake Harbor Ln.  
Boise, ID 83703  
tpyle@greatwesteng.com

RE: **Geotechnical Engineering Evaluation**  
Bonner County Waste Transfer Facility  
119 Colburn Culver Road  
Colburn, Idaho

Greetings, Travis:

GeoProfessional Innovation Corporation (GPI) appreciates another opportunity to work with you and your team, as well as the Bonner County Solid Waste Department to facilitate significant improvements to the existing waste transfer facility located outside of Colburn, Idaho. The remainder of this transmittal letter provides you and the project team information on how to interpret and apply our deliverable.

#### **YOUR DESIGN DELIVERABLE**

This letter and the appended deliverable includes our geotechnical design delineating the earthwork construction requirements for the planned improvements to the solid waste facility for the specific location, configuration, and description outlined in the deliverable. Please read, understand, and implement the criteria in their entirety. Do not read or rely on select elements only. Geotechnical design continuity is enhanced through regular consultation and incrementally evaluating construction timing, bids, and changes that may be realized at the time work is implemented. GPI remains available to verify that design is understood and properly incorporated into construction.

#### **Project-Specific Design Factors**

GPI considers a number of unique, project-specific factors when establishing our scope of our services. Typical factors include the project goals, objectives, and risk management preferences; the general nature of the structure(s) involved, size and configuration, and the project location. Typical changes that can reduce the reliability of the deliverable include those that affect:

- ✘ The function of the proposed structure(s)
- ✘ Elevation, configuration, location, orientation, loading, and/or proximity to existing utilities/structures
- ✘ Site grades and drainage requirements
- ✘ Other factors that have the potential to impact our analysis or construction criteria

As a general rule, *always* inform GPI of project changes – even minor ones – and request an assessment of their impact to design. If our *Project Understanding*, as delineated in the project plans, is not correct, please notify us immediately. *We cannot accept responsibility or liability for problems that occur because our documents do not consider developments of which we were not informed.*

### **Subsurface Conditions Can Change**

Unknown or unanticipated subsurface conditions are a principal cause of construction delays, cost overruns, and disputes. Site exploration identifies only a small portion of the site's subsurface conditions, which can change significantly between exploration locations. GPI performed 4 exploratory borings in the planned building improvement areas and we utilized and relied on prior exploratory test pit data performed by others and supplied by Great West. We relied on the field and laboratory data to apply our professional judgment rendering an opinion about the subsurface conditions at the project improvement locations. Actual subsurface conditions may differ – sometimes significantly – from those identified in our deliverable. This is especially true for sites that have previously been graded and developed such as this one.

### **GPI's Deliverables Can Be Subject to Misinterpretation**

To help prevent costly problems, construction documents should clearly delineate how you intend the design team and subcontractors to rely on the geotechnical engineering deliverable. You can also lower the risk of costly problems from misinterpretation by having GPI confer with appropriate members of the project team during the entire design and construction process. We look forward to providing our review of pertinent final aspects of the plans and specifications.

### **Geotechnical Recommendations Are Not Final**

*The design and resulting construction requirements are not final*, because GPI engineers develop them principally from judgment and opinion. Construction continuity is the industry standard and a critical element of the geotechnical design process. GPI can confirm our recommendations only by observing actual subsurface conditions revealed during construction. If, due to the project site distance, a firm or individual other than GPI is retained to observe, test, or interpret actual field conditions, they are assuming an aspect of the geotechnical design process and are responsible for implementing design and interpreting the conditions exposed during construction. It is important to notify this entity of their role and responsibility.

### **Read Responsibility Provisions Closely**

Geotechnical engineering is a far less exact science than other engineering disciplines. Geology does not behave uniformly or linearly and is subject to change based on various factors beyond anyone's control. This lack of understanding and the presumption that geotechnical design can be administered similar to other design disciplines has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, GPI includes an *Evaluation Limitations* section herein to indicate where GPI's responsibilities begin and end to help others recognize their own responsibilities and risks. *Read these provisions*. Ask questions; GPI will respond fully and frankly.

### **Design Alternatives Analyzed**

GPI worked with Great West to help identify grading and material reuse concepts that would reduce the financial investment of certain components of construction. Additionally, we worked with Great West to evaluate the potential for mechanically stabilized earth construction to reduce retaining wall investment. Ultimately, given the short spans of retaining wall that did not support buildings, the MSE concept was not incorporated into final design. We evaluated structural design as it relates to foundation bearing pressure modifications, granular soil improvements, and foundation bearing depth. Each of these was considered with respect to the potential for construction cost savings through reduced materials or construction effort. The results of these efforts are incorporated into the foundation design requirements outlined in the project plans.

GPI assessed the observed subsurface conditions and in-place density to analyze the site soil's anticipated response to the estimated structural loading from the wall and column foundations for the proposed Waste



Transfer Building (WTB). Considering the relatively loose consistency, there is a heightened potential for settlement exceeding the tolerable limits (1 inch) if no improvements at the subgrade are implemented. We conducted sensitivity analyses to model the settlement due to the new loading on compacted site soil and at varying granular soil improvement (GSI) thicknesses. Through our analyses and discussions with Great West, we ultimately recommend 2 feet of GSI be placed beneath continuous foundations and column foundations less than 4 feet wide for the WTB. Columns greater than 4 feet wide require 3 feet of GSI to maintain vertical settlement tolerances. A separating geotextile fabric shall be placed on the prepared subgrade and granular structural fill placed to help support the new foundations for the WTB. To reduce the risk of differential performance as well as aid in construction, we also recommend the hazardous household waste (HHW) building receive 0.8 feet of GSI beneath planned foundations, also including the geotextile fabric. Please notify GPI should the anticipated foundation loads or elevations change from those evaluated under our scope, as they may have substantial impact to our requirements.

To evaluate performance of the planned foundations at the WTB, GPI utilized analysis methods including traditional settlement estimating equations for granular soil developed by Schmertmann (1978) as well as modern finite element analysis software. This finite element, load-deformation analysis software, Sigma/W, was developed by Geo-Slope International, Inc. To formulate our analysis, we developed a geologic model for the planned foundation configuration and existing site conditions that incorporates subsurface conditions encountered in our borings and soil engineering parameters estimated from field and laboratory testing. This geologic model for the WTB is illustrated in Appendix A, *Finite Element Analysis*.

We utilized finite element analysis and typical load deformation equations to develop the settlement estimates provided in the plan sheets attached to this letter. Predicted settlement estimates within the building footprint are within the allowable tolerances outlined by Great West. The estimates provided assume the foundation configuration and geometry remain unchanged from that described on the plan sheets herein. Specifically, it is important to maintain drained conditions adjacent and immediately below the bearing elevation. Where soil conditions or compaction effort vary from those outlined and specified herein, settlement will vary. Our finite element results illustrating estimated settlement are illustrated on Figure A.3 in Appendix A.

### **Design Continuity**

*The design and resulting construction requirements are not final*, because engineers develop them principally from judgment and opinion. Construction continuity is the industry standard and a critical element of the geotechnical design process. GPI maintain the necessary personnel, project familiarity, and expertise to provide consultation including material testing and construction surveying throughout construction to complement and validate our design. In fact, GPI can confirm our design criteria only by observing actual conditions revealed during construction.

Maintaining the engineer-of-record by retaining GPI to provide construction observation can reduce misinterpretation of design and construction criteria. This may be especially important given the misinterpreted geotechnical information previously provided that ultimately caused a higher than anticipated construction cost estimate. If retained, our work includes responding to requests for information, reviewing bids, and construction sequencing. If for some reason a firm or individual other than GPI is retained to observe, test, or interpret actual field conditions, they are assuming the engineer-of-record role and are responsible for implementing design. It is important to notify this entity of their role and responsibility, have them review the structural and civil plans, and confirm geotechnical design has been implemented as intended.

### **EVALUATION LIMITATIONS**

The geotechnical services provided herein did not include civil or structural design, retaining wall design, hydrologic stormwater modeling or establishing groundwater gradients, subsurface dewatering design,

infiltration testing, shoring or underpinning, cost estimating, deep foundations, or any other services not explicitly discussed herein. Neither did we perform a 100-foot-deep boring to assess IBC seismic site class or confirm liquefaction potential. Rather, we relied on published information in the area such as well logs and our exploration results near the surface. We communicated to you that liquefaction risks exist on this site.


GPI's findings are based on the site's current and planned utilization as well as the information collected from the tasks described herein. No warranties, express or implied, are intended or made.

There are inherent risks whenever soil, geologic, or hydrogeologic conditions are involved with a development. This is especially true on previously developed sites and where dumping has occurred. Soil and geologic material, especially groundwater, are variable in nature. Conditions may change between exploration locations and at depth. Specifically, uncontrolled fill and refuse deposits can change substantially in short lateral distances. Extrapolating substantially beyond the immediate exploration area has obvious risks, which must be considered by the project team.


### CLOSING

We are pleased to provide Great West Engineering with this geotechnical deliverable, and we look forward to seeing this project advance through construction. If you have any questions regarding this deliverable or need more information, please contact us.

Sincerely,  
GPI



Justin Maffey, P.E.  
Project Engineer



Travis J. Wambeke, P.E.  
Principal Engineer

TJW/mg

Attachments: Plan Sheets GT1 to GT7  
Appendix A, Finite Element Analysis



# BONNER COUNTY WASTE TRANSFER FACILITY



## GEOTECHNICAL DESIGN BASIS

## General

- In

- International Building Code, 2018
  - o IBC Chapters 16 and 18
- GPI's field exploration, reference sheets GT6 and GT7
  - o Borings advanced on October 17, 2022.
- Laboratory testing, reference sheet GT7
- Foundation frost depth - 2.5 feet
- Structural loads provided by Great West Engineering:
  - o Total isolated maximum column load: 100 kips
  - o Total conventional maximum strip footing load: 4 klf
  - o Total retaining wall maximum footing load: 21 klf
- Seismic Site Class E (Reference IBC Section 1613 and ASCE 7).
- Structural settlement tolerances provided by Great West Engineering:
  - o Maximum total vertical settlement: 1.0 inch
  - o Maximum total differential settlement: 0.75 inches (30-ft span)
- Bearing capacity failure, factor of safety (FOS) = 3 or greater
- Settlement estimates are unfactored

## PROJECT UNDERSTANDING

**1**

## Existing Conditions and Proposed Construction

The Bonner County Waste Transfer Facility is located at 119 Colburn Culver Road in Sandpoint, Idaho. Access to the facility is off Pinecone Road to the south of Colburn Culver Road via asphalt-paved and gravel-surfaced driving lanes. A new waste transfer building (WTB), CFC removal building, and a household hazardous waste (HHW) building will be constructed at the existing waste transfer station. Each will be steel framed with the CFC and HHW having relatively light loads estimated at less than 2 kips per linear foot (klf) along walls and no columns. The WTB will have large (nearly 20-foot-tall), cast-in-place retaining walls at the tunnel that connect to the building's steel frame. The retaining wall near grid line B carries approximately 17 klf. Column loads will not exceed 100 kips at grid lines 1 and 6 and continuous wall loads along the scales will not exceed 10 klf. Interstitial columns along grid line D between grid lines 2 and 5 will support loads less than 20 kips.

Heavy duty, reinforced concrete slabs will provide the tunnel and tipping floors. Additionally, two scales/scale pits will be founded on conventional footings inside the tunnel of the WTB. The large concrete retaining wall at the WTB tunnel is required to provide the level of rigidity and durability performance required for equipment loading. This wall will taper and ultimately connect to the existing waste transfer building wall. Utilities to the new buildings will extend from existing connections. Pavements will be constructed and/or patched back to match existing sections. Stormwater systems will be expanded from existing facilities.

## Subsurface Conditions

Exploration was accomplished via 4 soil borings extending 16.5 to 36.5 feet below the ground surface (BGS) via a trailer mounted, G2400 equipped with hollow stem augers and standard penetration test (SPT) equipment. Approximate boring locations are shown on sheet GT6. During exploration, the subsurface geology was visually classified, described, and logged in reference to the USCS. In-place soil samples were collected from various depths and boring locations for subsequent laboratory testing. The USCS is presented on GT6, and shall be used to interpret the soil conditions described in this document and on the individual exploration logs. Borings were loosely backfilled and plugged with bentonite at exploration completion. Prior exploration was accomplished and was used to extrapolate subsurface information derived from GPI's exploration.

Asphalt was encountered at the ground surface in boring B-22198A-4 measuring 6-inches-thick and was underlain by 5 inches of base course described as poorly-graded gravel that was gray, medium dense, and damp. Besides asphalt and base course, the following subsurface soil units were encountered during exploration:

**Undocumented fill:**

- Silty Sand (SM): Light brown, loose, and damp to moist. The silty sand fill was encountered at the ground surface in borings B-22198A-1, -2, and -3 and beneath the asphalt and base course section in B-22198A-4. Silty sand fill extended 1.5 to 4.0 feet BGS and likely originated from previous earthwork and construction activities that graded the site.

### Alluvium:

- Silty fine Sand (SM): Light brown to brown with tan mottling, loose to medium dense, and damp to moist. Alluvial silty fine sand was encountered in borings B-22198A-1 and -4 beneath undocumented fill extending to termination depths and in B-22198A-2 and -3 beneath the alluvial silt unit described below and extending to termination depths.
- Silt with Sand (ML): Light grayish brown, loose, and damp to moist. Alluvial silt with sand was encountered in B-22198A-2 and -3 beneath undocumented fill extending 8.0 to 8.5 feet BGS, underlain by the alluvial silty fine sand extending to termination depths.

Neither bedrock nor groundwater were encountered in the locations and depths explored.

## REFERENCES

## 3

The geotechnical evaluation herein is based on the authorized geotechnical scope dated September 23, 2022, and the latest versions of the ASTM International standards, Standard Methods for the Examination of Water and Wastewater (SM), Idaho Standards for Public Works Construction (ISPWC), and other reference standards listed below:

## Field Exploration

- ASTM D 420 - Guide to site characterization for engineering, design, and construction
- ASTM D 2487 - Test method for classification of soils for engineering purposes (USCS)
- ASTM D 2488 - Practice for description & identification of soil (Visual-manual procedure)s

## Construction Standards

- ISPWC 2017 edition

### Laboratory Investigation

- ASTM D2216 - Laboratory determination of water content of soil and aggregate
- ASTM D1557 - Laboratory compaction characteristics of soil using modified effort
- ASTM D2435 - One-dimensional consolidation of soil
- ASTM D2937 - In-place density of soil
- ASTM D4318 - Atterberg Limits
- SM 4500-H<sup>+</sup> B - Test method for measuring pH of soil
- SM 2510 B - Test method for electrical conductivity for soil resistivity
- SM-4500 SO<sub>4</sub> E - Test Method for measuring sulfate content of soil

	REV	DATE	DESCRIPTION	CHECK: TJW	DRAWN: JBM
<b>ISSUED FOR</b> <input checked="" type="checkbox"/> DESIGN USE <input type="checkbox"/> PRELIMINARY REVIEW <input type="checkbox"/> YOUR APPROVAL <input type="checkbox"/> REFERENCE <input type="checkbox"/> CONSTRUCTION <input checked="" type="checkbox"/> DESTROY PREVIOUS PRINTS	<u>A</u>	11/21/22	SUMMARY	FILE: MO22198A	DESIGN: JBM
	<u>A</u>	12/20/22	60% DRAFT	PROJECT:	PREPARED FOR:
	<u>A</u>	2/1/23	90% DRAFT	BONNER COUNTY WASTE	GREAT WEST ENGINEERING
	<u>A</u>	2/15/23	FINAL	TRANSFER FACILITY	3050 N LAKE HARBOR LN
				GEOTECHNICAL ENGINEERING	BOISE, ID 83703
			EVALUATION	ATTN:	
				119 COLBURN CULVER ROAD	MR. TRAVIS PYLE, P. E.
				BONNER COUNTY, IDAHO	



**GPI** 6 O'Donnell Road Pullman, WA 99163 509.339.2000

# GeoProfessional Innovation®





## EARTHWORK

## Site Stripping/Preparation

1. Limited topsoil stripping is anticipated due to previous development. Remove topsoil containing vegetation and organics from beneath the proposed improvement areas.
2. Isolated thicker topsoil deposits are possible and must also be removed during site stripping operations.
3. Topsoil stockpiles and debris are not suitable for use as structural fill.
4. Locate existing utility trenches beneath new building footprints; remove abandoned utility piping and loose soil along utility alignments and replace it with *Structural Fill*.

## Demolition

1. Demolition activities shall remove existing asphalt, foundations, utilities, slabs, and any designated building or at-grade features to the subgrade elevations and expose native soil to be verified by the project geotechnical engineer-of-record (GER) retained for construction.
2. Demolishing existing structures such as asphalt, foundations, or utilities may require equipment with “breakers,” “rippers” or pneumatic hammers.
3. Remove concrete (foundations, slabs, or other) to at least 2 feet below new concrete bearing surfaces (foundations, slabs, etc.).
4. Remediate depressions caused by removing demolished site features by placing *General Structural Fill* according to Table G3.1 and G3.2 over native soil subgrade prepared per the *Subgrading* section.

**Undocumented Fill:**

1. Limited fill was encountered during exploration associated with prior development and will be removed as part of subgrading efforts.
2. Where remnant fill remains below structures after subgrading, remove it extending 5-feet laterally. Remove fill to expose undisturbed native alluvial soil and compact the subgrade per the *Subgrading* section. Replace over-excavated fill with compacted *Structural Fill*, referencing Section 6 requirements.
3. Undocumented fill can be reused as *General Structural Fill* (SF-1) provided it is processed to meet the *Structural Fill*, Section 6, requirements.
4. The geotechnical engineer-of-record for construction (GER) shall observe and document demolition excavations and fill over-excavations prior to placing *Structural Fill* and/ or concrete.

## Subgrading

1. Project subgrades are defined as follows:
  - Base of any depression created by topsoil or fill removal.
  - Base of any utility trench.
  - Slab and pavement section subgrades.
  - Foundation subgrade.
  - Embankment subgrade
  - Over-excavations
  - Any in-situ soil surface to receive *Structural Fill*.
2. Once topsoil stripping and excavation to achieve embankment, foundation, pavement, and hardscape subgrades is complete, prepare subgrades by proof compacting the subgrade to the *Structural Fill*, Section 6 requirements.
3. The GER shall review site preparations, subgrading efforts, and over-excavations prior to *Structural Fill* placement.
4. After achieving subgrade, the contractor shall protect the subgrade from becoming disturbed, saturated, or frozen. Control prepared subgrading by limiting construction traffic and reducing the subgrade's exposure to precipitation, water, and freezing conditions. Remediate areas damaged by construction activity at no additional cost to the County.
5. Grade subgrades to direct surface water away from construction areas to avoid infiltration.

### Excavation Characteristics

1. Site soil is expected to be excavatable using conventional excavation techniques and equipment.
2. Bedrock excavation is not expected within the planned construction depths.
3. Temporarily excavate, slope, shore or brace excavations in accordance with the *Occupational Safety and Health Administration* (OSHA) regulations and local codes.
4. In a dry condition, the on-site soil is classified under OSHA as Type C soil; pending configuration, temporarily slope at least 1.5H:1V (horizontal:vertical).
5. Construction vibrations, seepage, or surface loading can cause excavations to slough or cave and should be avoided.
6. Ultimately, the contractor is solely responsible for site safety, excavation configurations, and maintaining OSHA-approved personnel for excavation monitoring.
7. Plan excavations carefully, allowing water collection points and utilizing conventional sumps and pumps to remove nuisance water from runoff, seeps, springs, or precipitation.
8. Coordinate construction activities and excavation backfilling as rapidly as possible following excavation to reduce the potential for subgrades to degrade under construction traffic.
9. Maintain dewatering systems during wet weather to facilitate good drainage and reduced over-excavation.
10. Discharge collected construction water into temporary stormwater and sediment facilities established as part of the contractor's stormwater management plan.

## Over-Excavation

1. Over-excavation is anticipated for granular soil improvements below foundations and to remove isolated undocumented fill beneath new structures.
2. Soft, loose, wet, pumping, or rutting areas that cannot achieve compaction following adequate moisture conditioning and undocumented fill below new structures must be removed to expose medium dense, unyielding native soil at the direction of the GER.
3. Replace these over-excavations with *Granular Structural Fill* (SF-2) as described in *Structural Fill*, Section 6.
4. Determine soft, loose soil over-excavation criteria during construction with the GER. Over-excavations, unless otherwise specified, shall extend at least 1 foot below the subgrade and laterally 1/2 the depth.

### Wet Weather/Wet Soil Construction

1. Ideally, perform earthwork construction during dry weather conditions (typically May through November).
2. The site soil is susceptible to pumping or rutting from heavy vehicle and equipment loads. The key to reducing rework with the site soil is to minimize disturbance to it.
3. If earthwork occurs during wet periods, accomplish work at or near final subgrade with equipment that imparts low bearing pressures, track-mounted, and low tire pressure equipment. Using high ground-contact pressure equipment such as dump trucks, scrapers, and loaders can readily pump and rut the subgrade and their application shall be carefully considered.
4. Complete earthwork by track-mounted equipment that reduces vehicular pressure applied to the soil if construction commences in wet areas or before soil can dry.
5. Stage construction, specifically excavation and backfilling, to avoid traffic on subgrades.
6. Depending on precipitation, runoff, and perched groundwater conditions, the site soil may be over optimum moisture content. Contractors shall expect these conditions and be prepared to install runoff management facilities and to replace wet or disturbed soil with SF-2 after moisture conditioning.
7. Stormwater sheet flow towards or across the earthwork area can occur during storm events. Contractors shall expect these conditions and be prepared to install runoff management facilities to prevent stormwater from reaching active earthwork areas.

### Utility Trench Backfill

1. Remove all saturated, loose, and/or disturbed soil from the bottom of the utility trenches prior to placing pipe bedding.
2. Accomplish bedding for pipes, conduits, and utility trenches in accordance with ISPWC and the project specifications.
3. Backfill the remainder of utility trenches in accordance with the *Structural Fill*, Section 6 requirements.
4. When existing utilities exist below buildings, completely remove the utility trench backfill and piping. Replace with structural fill.

## Earthwork Testing

The firm retained to verify subgrade conditions, required fill removal, soil bearing units, and compaction shall become the geotechnical engineer-of-record for construction (GER). At a minimum, the following earthwork testing frequencies shall be implemented.

1. Remove abandoned utilities and loose soil and replace trenches with *Structural Fill*.
2. All subgrades must be observed by the GER prior to placing *Structural Fill*, footing concrete, or hardscapes. GER shall verify foundation and substrate design criteria. Also, 1 compaction test every 2,000 square feet prior to structural fill placement and GER shall verify compaction in foundation alignments, 2 tests per column and wall alignment.
3. Site Grading/Structural Fill Placement – One compaction test every 2,000 sf, per fill lift, minimum 3 tests per testing event.
4. Pavement and Slab Support Aggregate – One compaction test every 2,000 sf or a minimum of 4 tests per area, whichever results in the greater number of tests, per fill lift.
5. Utility Trench Backfill – One compaction test every 100 lf of trench and minimum 3 tests per utility alignment, whichever results in the greater number of tests, per each fill lift.
6. Foundation/Wall Backfill – One compaction test every 100 lf of wall or minimum 3 tests per wall line (interior and exterior sides), whichever results in the greater number of tests, per fill lift.
7. Asphalt Pavement Construction – 1 compaction test every 2,500 sf, per paving lift. 1 laboratory test suite on a bulk sample of hot mix asphalt per each day's paving, including oil content, gradation, and theoretical maximum specific gravity (Rice).

## GEOSYNTHETICS

Geotextile separation fabric is required for granular soil improvement construction. Where utilized, geosynthetic shall meet the following material and placement requirements

<b>Geosynthetic Type</b>	<b>Use</b>	<b>Material Specifications</b>
Woven Separation Fabric	Granular soil improvements, asphalt pavement sections	<ul style="list-style-type: none"> <li>- Must meet Subgrade Separation – ISPWC Standards Section 2050 - Part 2.3 (Type I)</li> <li>- Min. 180 pound grab tensile strength (ASTM D 4632)</li> <li>- Min. 70 pound puncture resistance (ASTM D 6241)</li> <li>- Min. 70 pound tear strength (ASTM D4533)</li> </ul>
Biaxial or Triaxial Geogrid	Extremely soft subgrade conditions	<ul style="list-style-type: none"> <li>- 93 percent junction efficiency (GRI-GG2-05)</li> <li>- 6.5 m-N/degree Torsional Rigidity @ 20 kg-cm (GRI-GG9)</li> <li>- Punched and drawn polypropylene Minimum Radial Stiffness of 15,400 lb/ft at 0.5% Strain (ASTM D6637)</li> </ul>

## Geosynthetics

1. Geosynthetic fabrics that do not meet the requirements in Table G2.1 above may be used only if approved by the GER.
2. Geosynthetic fabrics are applicable when constructing on soft or wet soil as separation and stabilization fabrics.
3. Where required to aid construction or increase long-term performance, apply geosynthetics directly on approved subgrades, taut, free of wrinkles, and over-lapping at least 1-foot.
4. Consult the GER to review geosynthetic applications or other subgrade improvement alternatives.
5. Geogrid is not expected to be required unless extremely soft subgrades develop during construction due to unusually high groundwater or construction during wet seasons.
6. Construction timing can impact the need for geosynthetics, specifically, geogrid.

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- ☒ DESTROY

PREVIOUS PRINTS

REV	DATE	DESCRIPTION
A	11/2/22	SUMMARY
A	12/20/22	60% DRAFT
A	2/1/23	90% DRAFT
A	2/15/23	FINAL

119 COLBURN CULVER ROAD BONNER COUNTY, IDAHO	PROJECT: BONNER COUNTY WASTE TRANSFER FACILITY GEOTECHNICAL ENGINEERING EVALUATION	FILE: MO22198A	CHECK: 12/94
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DESIGN: JBM  
 PREPARED FOR:  
 GREAT WEST ENGINEERING  
 3050 N LAKE HARBOR LN  
 BOISE, ID 83703  
 ATTN:  
 MR. TRAVIS PYLE, P.E.



**GPI** 60'Donnell Road Pullman, WA 99163 509.339.2000



6

STRUCTURAL FILL

Material Requirements

1. On site soil may be used as *General Structural Fill* (SF-1) so long as it meets the requirements provided in Table G3.1, below.

2. Material requirements for structural fill reference the 2017 ISPWC and are described in Table 3.1, below.

Table G3.1: Structural Fill Specifications and Allowable Use

NSF	Non-Structural Fill (Landscape, Fill, or Topsoil)	- Any area that will not support pavements, foundations or other improvements, (typically landscape areas)	- Soil classified as GW, GM, GP, GC, SM, SW, SP, SC, or ML according to the USCS. - Soil may not contain particles larger than 1 foot in median diameter. - Soil must be reasonably free from deleterious substances such as wood, metal, plastic, waste, etc.
SF-1	General Structural Fill	- General site grading - Foundation wall backfill - Utility trench backfill	- Soil classified as GW, GP, GM, SP, SM, SW, or ML according to the USCS. - Soil must contain less than 3 percent (by weight) of organics or other deleterious substances. - Soil may not contain particles larger than 1 foot in diameter. - Site soil is anticipated to meet this criteria - Coarse granular soil locally know as "shotrock" or "pitrun" is suitable SF-1
SF-2	Granular Structural Fill	- Over-excavations - Foundation wall backfill - SF-1 applications	- Meeting requirements in ISPWC <i>Section 801 - UNCRUSHED AGGREGATES</i> - Crushed products are acceptable
CA-1	Crushed Aggregate	- Granular soil improvements - Slab and pavement support aggregate - SF-2 applications	- Meeting requirements in ISPWC <i>Section 802 - CRUSHED AGGREGATES</i>
PB	Pipe Bedding	- Utility pipe bedding within 0.5-feet of the pipe invert and 1-foot over the pipe	- Meeting requirements in ISPWC <i>Section 305 - PIPE BEDDING</i>
DA	Drainage Aggregate	-Foundation/wall drains	- Meeting requirements in ISPWC <i>Section 801 - UNCRUSHED AGGREGATES</i> , Table 1 (Drain Rock)

Required Compaction

Subgrades and backfill supporting any structure or improvement must be compacted to Structural Fill requirements presented in Table G3.2.

Table G3.2: Required Structural Fill Products for Designated Project Areas		
Project Area	Required Structural Fill Product	Compaction Requirement <sup>A</sup>
Foundation subgrades	On-site soil	NA <sup>B</sup>
Slab/hardscape subgrade	On-site soil	92%
Utility trench backfill, general site grading	SF-1, SF-2 <sup>C</sup> , CA-1	95%
Foundation/wall backfill, over-excavations	SF-1, CA-1, SF-2 <sup>C</sup>	95%
Pavement and slab-on-grade support sections	CA-1	95%
Landscape areas sloped flatter than 5H:1V	Landscape Fill, Topsoil	85%

Table G3.2 Notes:

A. Relative compaction requirement compared to the maximum dry density of the soil as determined by ASTM D1557 (Modified Proctor).

B. Subgrades beneath granular soil improvements need proof compacted to dense and unyielding conditions with deflections less than 0.3 inches.

C. Coarse soil with greater than 30% retained on the 3/4-inch sieve shall be compacted to the *Coarse Fill* section requirements.

1. Structural fill shall not contain particles of frozen soil, mud, snow, or ice. Structural fill shall not be placed on frozen subgrades.

2. Structural fill products must be moisture conditioned to near optimum moisture content, placed and compacted in maximum 1-foot-thick, loose lifts, providing compaction equipment weighs a minimum of 5 tons. If smaller or lighter compaction equipment is provided, reduce the lift thickness to meet the compaction requirements presented herein.

Coarse Fill

1. Any material with greater than 30 percent retained above the ¾-inch sieve is too coarse for Modified Proctor density testing, but may be used as SF-1 and SF-2. Coarse fill must be compacted using a “method specification” developed during construction that is based on the material characteristics and the contractor's means and methods.

2. Develop method specifications during construction with the GER and specific to the materials, compaction equipment, and conditions encountered.

3. One coarse fill method specification exists in section 202.3.8.C.3 of the ISPWC Standards

4. At a minimum, place all coarse fill in maximum 1.5-foot lifts and compact with 5 complete passes of a minimum 10-ton, vibratory or grid roller.

5. Vibratory rollers shall have a dynamic force of at least 30,000 pounds per impact per vibration and at least 1,000 vibrations per minute. Coarse fill must be compacted to a dense, interlocking, and unyielding surface. Vibratory rollers can negatively impact adjacent structures and moisture sensitive subgrades, and must be used with caution.

7

SITE DRAINAGE

Exterior Grading

1. Site grading design and construction must allow for positive drainage of surface runoff water away from the structures, retaining walls, and not be allowed to infiltrate new foundation and slab subgrades.

2. Convey runoff or water migrating along the ground surface away from existing and proposed structures by an appropriately designed series of ditches, hardscapes, swales, trench drains or other surface water management procedures.

3. Per IBC Section 1804.4, slope all surfaces within 10 feet of the structure away at 5 percent except where the *American Disabilities Act of 1990* (ADA) requirements must be met. Where IBC standards cannot be met, slope ground as aggressively as possible to direct water away from the building's perimeter.

4. Slope the remaining sidewalks, aprons, and paved surfaces per Great West's design away from the structures. This reduces the risk of subsurface soil near the foundation becoming saturated due to water ponding near structures or pavement edges.

5. Provide roof drains to collect and direct water away from foundations.

6. Provide and connect roof downspouts to a solid pipe placed around the structures perimeter and do not allow water to infiltrate into the soil underlying the new structures.

7. Avoid landscaping that requires irrigation adjacent to structures.

Foundations/Walls

1. Install drains at exterior foundations and retaining walls and slope to gravity drain. Dispose of collected water in a stormwater system positioned at least 50 feet away from structures.

2. Never connect foundation or retaining wall drains to roof drains.

3. Divert water collected in foundation and roof drains to the stormwater disposal system designed and specified by Great West.

8

PAVEMENT

Isolated Full Depth Construction

1. Isolated, full depth sections or repairs may be necessary to remediate small areas of distressed asphalt or for patch back near new structures.

2. Provide asphalt section materials complying with ISPWC section 800 and the project specifications.

3. Saw cut the distressed areas as delineated by Great West.

4. Excavate neat to the saw cut lines, extend excavation 1-foot below the pavement subgrade. Dispose of excavated material. Excavated material becomes the property of the contractor.

5. Compact the exposed subgrade to the *Structural Fill*, Section 6 requirements.

6. Place woven geotextile fabric and extend up the excavation sidewalls to the asphalt pavement subgrade. Geosynthetics shall meet the requirements in Section 9, *Geosynthetics*. Where full depth repairs measure less than 10-feet in width, geosynthetic shall be placed in a single, uniform piece without splices.

7. Place at least 0.7-feet of CA-1 in appropriate lifts and compact to *Structural Fill*, Section 6 requirements. Finished pavement subgrades shall be smooth, uniform, free of pumping or rutting, and graded to allow at least 0.35 feet of asphalt pavement to match existing grades.

8. Tack coat and saw cut edges prior to paving. Apply approved asphalt pavement in 2 uniform lifts and compact to a minimum of 92 percent of the theoretical maximum density as estimated by AASHTO T 209.

Slurry Seal Pavement Maintenance

Accomplish slurry seal every 5-years as a maintenance provision, according to the following:

1. Cleaning: Ensure that cracks are thoroughly clean, dry, and free of all loose and foreign material when filling with crack sealant material. Use a hot compressed air lance to dry and warm the pavement surfaces within the crack immediately prior to filling a crack with the sealant material. Do not overheat pavement. Flame dryers are not allowed.

2. Sand Slurry: For cracks greater than 1-inch-wide, fill with sand slurry by thoroughly mixing the components and pour the mixture into the cracks until full. Add additional CSS-1 cationic emulsified asphalt to the sand slurry as needed for workability to ensure the mixture will completely fill the cracks. Strike off the sand slurry flush with the existing pavement surface and allow the mixture to cure.

3. Hot Poured Sealant: For cracks less than 1-inch-wide, fill with hot poured sealant by applying the material in accordance with these requirements and the manufacturer's recommendations. Confine hot poured sealant material within the crack. Clean any overflow of sealant from the pavement surface.

4. Provide an emulsified asphalt-sand slurry seal mix with 2 to 10% sand mineral filler, 7 to 19% emulsified asphalt and admixtures as necessary to meet the appropriate AASHTO and *International Slurry Seal Association* (ISSA) test methods and guidelines.

5. Apply slurry seal mixture on clean, prepared asphalt surfaces at an average rate of 15 to 20 lbs/square yard. Remove excess seal mixture prior to curing.

6. Slurry seal will extend pavement life, but does not equate to a 20-year design.

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FILE: MO22198A

PROJECT:

BONNER COUNTY WASTE TRANSFER FACILITY GEOTECHNICAL ENGINEERING EVALUATION

119 COLBURN CULVER ROAD BONNER COUNTY, IDAHO

DRAWN: JBM

DESIGN: JBM

PREPARED FOR:

GREAT WEST ENGINEERING

3050 N LAKE HARBOR LN

BOISE, ID 83703

ATTN:

MR. TRAVIS PYLE, P.E.

GreatWest

ENGINEERING

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GT3 of 7



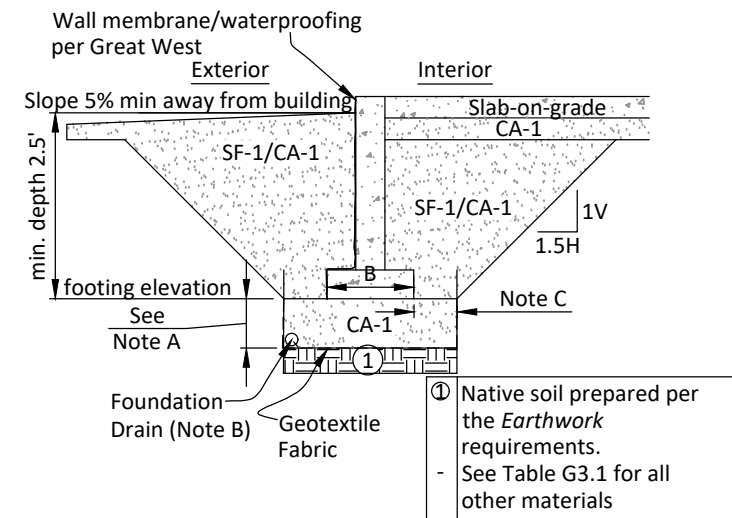
## FOUNDATION DESIGN

The following foundation design parameters are stated for the estimated structural loads outlined on sheet GT1 and are based on bearing new foundations on granular soil improvements to support relatively high structural loads and reduce the differential settlement potential from new foundation loads. From geotechnical field and laboratory testing, and engineering analyses, structurally design shallow foundations using the following criteria:

**Granular Soil Improvement Construction**

Construct granular soil improvements below new foundations according to the following steps:

1. Over-excavate soil vertically at least 0.8 feet for the HHW and CFC buildings and per Table G4.1 for the WTB. Extend over-excavations laterally 1/2 the depth exposing native soil.
2. Prepare native soil subgrades per the *Earthwork* requirements.
3. Place a woven geotextile fabric at the over-excavated subgrade and extend it up the sidewalls to the foundation bearing elevation. Geotextile fabric must meet the requirements in Table G2.1.
4. Backfill over-excavations with CA-1 placed and compacted referencing Table G3.1, Table G3.2 and the *Structural Fill*, Section 6 requirements.
5. Schematics illustrating the soil improvement process is provided in Figures G4.1 (column and continuous footings) and G4.2 (retaining wall footings). Wall heights will vary. Figures G4.1 and G4.2 are not structural details. Refer to the project drawings.



**Figure G4.1: Granular Soil Improvements Schematic (building column and continuous footings)**

**Notes:**

- A. Vertically extend soil improvements at least 0.8 feet below foundations for the HHW and CFC buildings and per Table G4.1 for the WTB.
- B. Construct footing drains with 0.3-foot-diameter, perforated PVC or ADS pipe. Adjust foundation drain pipe elevation to lowest possible elevation that maintains gravity drainage. Reference the *Site Drainage* Section 7 on Sheet GT3 for additional drain requirements.
- C. Laterally over-excavate 0.5 feet for every 1.0 vertical foot of granular soil improvement over-excavation.

**Table G4.1: WTB Granular Soil Improvement Schedule**

Foundation Type	Granular Soil Improvement depth (feet)
Continuous foundations	2.0
Column foundations ≤ 4.0 feet	2.0
Column foundations > 4.0 feet	3.0

**Foundation Design Criteria**

1. Maximum allowable bearing pressure: 3,000 psf
2. Maximum 33 percent increase allowed for short term load increases such as wind or seismic.
  - Requires foundations to bear directly on compacted, granular soil improvements per Figure G4.1.
2. Estimated foundation vertical settlement:
  - Total settlement: 1.0-inch
  - Differential settlement: Up to 0.75-inches in 30-foot horizontal span
3. Lateral load resistance:
  - Foundation base friction coefficient:
    - o 0.5 for foundations cast directly on granular soil improvements
    - o Reduce friction coefficient by 1/3 for precast concrete
  - Passive soil resistance on foundation sides:
    - o Equivalent fluid weight: 375 pcf for on-site soil backfill (SF-1)
    - o Requires 3/4-inch lateral movement to mobilize full resistance
4. Extend exterior footings at least 2.5-feet below the final, exterior ground surface to help protect against frost action.
5. Bear interior foundations for the HHW building at least 1.5 feet below finished slab elevations and maintain at least 0.5 feet of cover between top of the footing and the bottom of the concrete slab.
6. Avoid thickened footing configurations due to their propensity for reflective cracking.
7. The GER shall observe granular soil improvements, bearing surfaces, and slab subgrades.
8. Design criteria requires maintaining drained conditions at the foundation bearing subgrade.

**Seismic Activity Research**

1. Seismic design should reference the parameters provided in Table G4.2. based on a seismic site Class E.
2. The on-site loose sand suggests that the project site has a moderate liquefaction potential during an extreme seismic event.
3. The risk-targeted maximum considered earthquake (MCER) spectral response acceleration parameters provided have been modified from a Site Class B to a Site Class E.
4. The design spectral acceleration parameters provided in Table G4.2 are equal to 67 percent of the Risk Targeted MCER acceleration parameters.

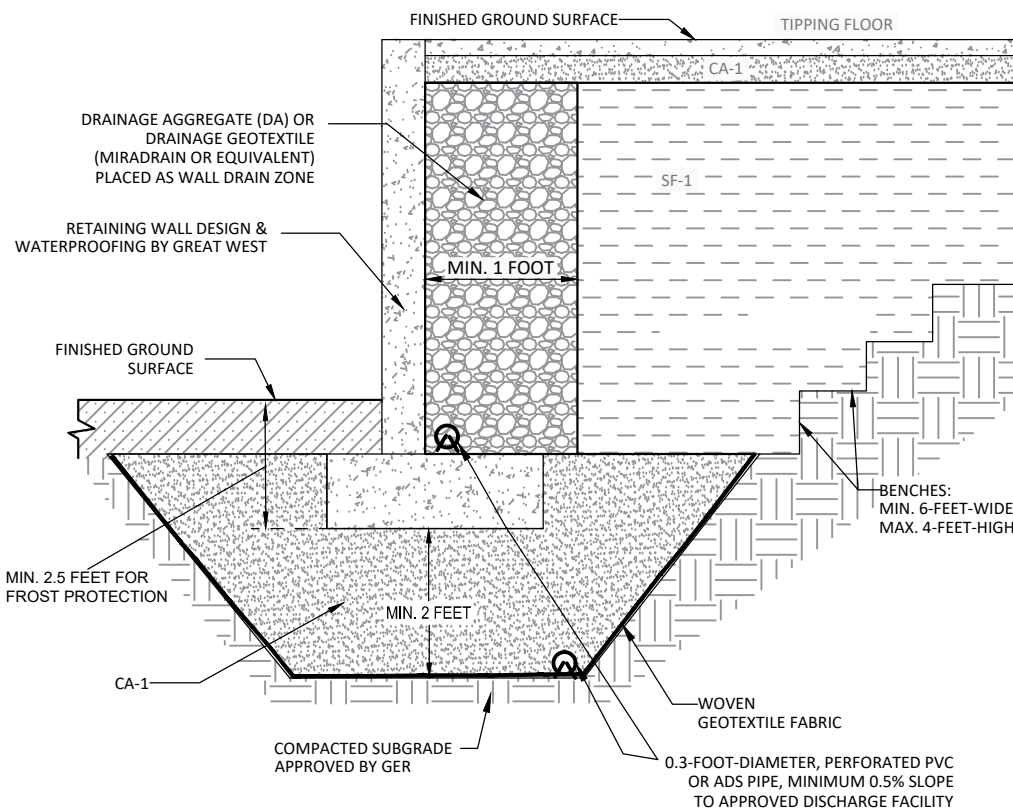
**Table G4.2: Seismic Response Criteria (ASCE 7-22)<sup>1</sup>**

Period (seconds)	Standard Acceleration Coefficients for Site Class B (g) <sup>2</sup>	MCER Spectral Acceleration Parameters for Site Class E (g) <sup>3</sup>	Design Spectral Acceleration Parameters for Site Class E (g)
0.0 (Peak)	-	$PGA_M = 0.22$	-
0.2 (Short)	$S_S = 0.35$	$S_{MS} = 0.60$	$S_{DS} = 0.40$
1.0	$S_1 = 0.096$	$S_{M1} = 0.41$	$S_{D1} = 0.27$

1. Values for location Latitude: 48.397833°N, Longitude: 116.522326°W.
2. Acceleration based on 2% probability of exceedance in 50 years (2,475 year return period).
3. Values for an ASCE Risk Category III.

**Soil Corrosivity**

1. pH = 6.7 - slightly acidic
2. Sulfates = 3.6 ppm - low
3. Resistivity = 25,000 ohm-cm - non corrosive
4. Account for the soil's slight corrosion potential in reinforcing steel spacing. Whenever possible, place steel with maximum clearances established through structural design.
5. Based on these corrosion parameters, special cathodic protection or the use of galvanized products for buried structures will not extend their practical useful life.
6. Site soil is suitable for Type I/II cement.



**Figure G4.2: Granular Soil Improvements Schematic (retaining wall footings)**

## LATERAL EARTH PRESSURES

**Lateral Earth Pressures**

Walls are anticipated for the WTB tunnel construction. Design below grade walls to resist lateral earth pressures from the retained soil adjacent to the structure. Also, lateral surcharge loads from equipment, slopes, or vehicles adjacent to the walls must be accounted for in structural wall design. Equivalent fluid weights provided in Table G4.2 may be used to calculate lateral earth pressures for below-grade wall design.

**Static Equivalent Fluid Weights**

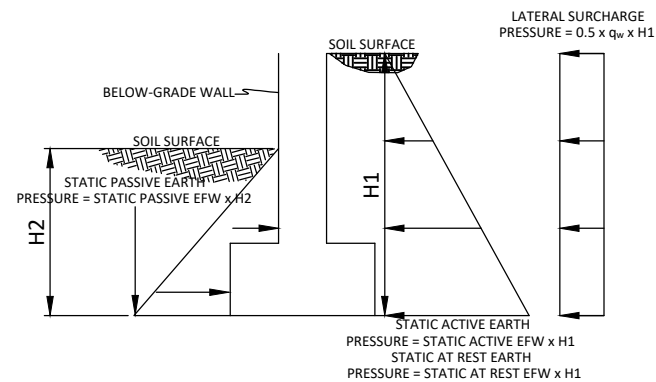
Apply lateral earth pressures for below grade wall design using the following equivalent fluid weights (EFW) from Table G4.3 and structural design judgment.

**Table G4.3: Static Equivalent Fluid Weights**

<i>On-site soil backfill (SF-1) (<math>\phi=31^\circ</math>) Drained Conditions</i>	
Lateral Earth Pressure Case	Equivalent Fluid Weight (EFW)
At-rest case (no wall movement)	57 (pcf)
Active case (wall movement away from soil mass)	39 (pcf)
Passive case (wall movement toward soil mass) <sup>A</sup>	375 (pcf)

A. Passive case assumes 3/4 inch lateral movement to fully mobilize passive resistance.

1. The provided EFWs in Table G4.3 assume fully drained conditions and no hydrostatic forces acting on the wall.
2. Below grade walls shall be constructed with adequate drainage and water proofing systems specified by Great West to reduce the potential for instability, leakage or seepage.
3. The provided EFWs assume the top surface of backfill adjacent to walls is level and seepage is collected and directed away from walls.
4. Lateral surcharge pressures due to equipment, hydrostatic forces, slopes, storage loads, etc. are not included in the provided EFW estimates. Use the lateral earth pressure coefficient of 0.5, acting over the entire below-grade wall height to estimate the lateral surcharge loads. Figure G4.3 illustrates the lateral earth pressure configurations.



**Figure G4.3: Static Lateral Earth Pressure Diagram**

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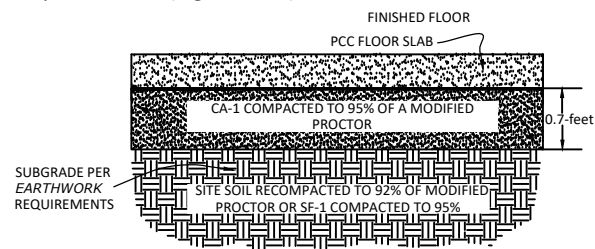


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## SLABS-ON-GRADE

**Slab Substrate**

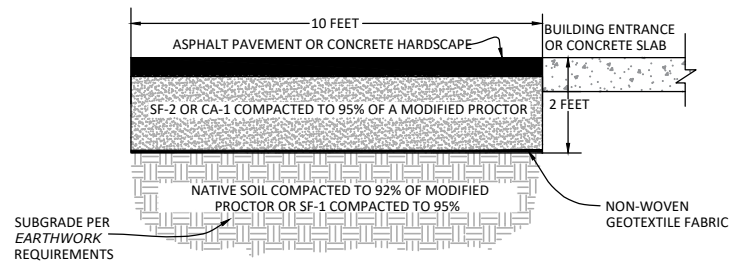
1. Support interior and exterior concrete slabs and aprons with at least 0.7-feet of CA-1 meeting Table G3.1 requirements, placed over compacted subgrades prepared per the *Earthwork* section requirements.
2. Subgrade areas that are soft, wet, or disturbed during slab subgrade preparations must be moisture conditioned and recompacted, or over-excavated to dense soil and replaced with CA-1.
3. Compact CA-1 below slabs to *Structural Fill* requirements.
4. Construct the slab's supporting subgrade, CA-1 layer, and any vapor retarders once the majority of underslab plumbing and utilities are completed.
5. Floor slabs and supporting base section thicknesses must be structurally designed for the anticipated use and equipment or storage loading conditions.
6. Concrete slab design may utilize an allowable modulus of subgrade reaction (k) of 240 pounds per cubic inch (pci) for slab sections constructed over compacted subgrade soil and at least 0.7-feet of compacted CA-1 (Figure G5.1) .

**Figure G5.1: Slab Schematic****Exterior Slab Joints**

1. Isolation (expansion/contraction) joints allow concrete expansion and contraction and reduce constriction of fixed, non-pavement structures.
2. Isolation joints shall be used adjacent to the following structures:
  - Building foundation
  - Building entrances
  - Curbs
3. Do not use isolation joints where curb and gutter contact rigid pavement, unless the curb and gutter is constricted by sidewalk or other "non-free-edge" situations.
4. If exterior concrete slabs or pavements will contact curb and gutter adjacent to sidewalks, the isolation joint shall be placed between the sidewalk, curb, and gutter.
5. If isolation joints are placed where wheel loads will access isolation joints, the concrete slab shall be increased in thickness by at least 20 percent.
6. All isolation joints shall extend the full slab thickness and be constructed according to ACI 330R-08.

**Frost Considerations**

1. Frost jacking/frost heave are rigid pavement design concerns, particularly where abrupt changes in soil frost susceptibility occur.
2. Abrupt changes may occur where rigid pavements meet flexible pavements or at building entrances and foundations.
3. To accommodate these locations excavate and remove frost susceptible material to the frost depth (2 feet vertically) and extending 10 feet from the building or at any trash enclosure.
4. Line the excavation with geotextile fabric and replace these over-excavations with SF-2 or CA-1 compacted to the *Structural Fill* section on Sheet GT3, reference Figure G5.2.
5. Consult the structural engineer regarding additional measures to help resist frost action.
6. Incorporate Xypex® at the recommended dosage per mix design for all exterior concrete.

**Figure G5.2: Reduced Frost Heave Section**

ISSUED FOR  
DESIGN USE  
PRELIMINARY  
REVIEW  
YOUR APPROVAL  
REFERENCE  
CONSTRUCTION  
DESTROY  
PREVIOUS PRINTS

REV	DATE	DESCRIPTION	CHECK: TJW	DRAWN: JBM
A	11/2/22	SUMMARY	FILE: MO22198A	DESIGN: JBM
A	12/20/22	60% DRAFT	PROJECT:	PREPARED FOR:
A	2/1/23	90% DRAFT	BONNER COUNTY WASTE	GREAT WEST ENGINEERING
A	2/15/23	FINAL	TRANSFER FACILITY	3050 N LAKE HARBOR LN
			GEOTECHNICAL ENGINEERING	BOISE, ID 83703
			EVALUATION	ATTN:
			119 COLBURN CULVER ROAD	MIR. TRAVIS PYLE, P.E.
			BONNER COUNTY, IDAHO	





## EXPLORATION MAP

## LEGEND

B-22198A-1



Approximate boring location observed by GPI on October 17, 2022.

(1.0)

Depth of undocumented fill observed (feet).

PROPOSED CFC BUILDING

PROPOSED HHW BUILDING

B-22198A-4  
(2.5)B-22198A-3  
(1.5)B-22198A-1  
(4.0)B-22198A-2  
(1.5)PROPOSED WASTE  
TRANSFER BUILDING

Reference: Site Plan provided by Great West Engineering. No scale intended.

## EXPLORATION LOGS

## UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE GRAINED SOIL	GRAVEL		GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES.
			GP	POORLY-GRADED GRAVEL, GRAVEL-SAND MIXTURES.
	GRAVEL WITH FINES		GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
			GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
	SAND		SW	WELL-GRADED SAND, GRAVELLY SAND.
			SP	POORLY-GRADED SAND, GRAVELLY SAND.
FINE GRAINED SOIL	CLEAN SAND		SM	SILTY SAND, SAND-SILT MIXTURES.
			SC	CLAYEY SAND, SAND-CLAY MIXTURES.
	SAND WITH FINES		ML	INORGANIC SILT, SANDY OR CLAYEY SILT.
			CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, SANDY OR SILTY CLAY.
	SILT AND CLAY LIQUID LIMIT LESS THAN 50%		CL-ML	INORGANIC MIXED CLAY AND SILT.
			OL	ORGANIC SILT AND CLAY OF LOW PLASTICITY.
			MH	INORGANIC SILT, MICA-CEOUS SILT, PLASTIC SILT.
			CH	INORGANIC CLAY OF HIGH PLASTICITY, FAT CLAY.
			OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY.
			PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS.
SILT AND CLAY LIQUID LIMIT GREATER THAN 50%				

## BORING LOG SYMBOLS

STANDARD 2 INCH OD SPLIT SPOON SAMPLE

CALIFORNIA MODIFIED 3 INCH OD SPLIT SPOON SAMPLE

ROCK CORE

SHELBY TUBE 3 INCH OD UNDISTURBED SAMPLE

## TEST PIT LOG SYMBOLS

GRAB BAG SAMPLE

BULK SAMPLE

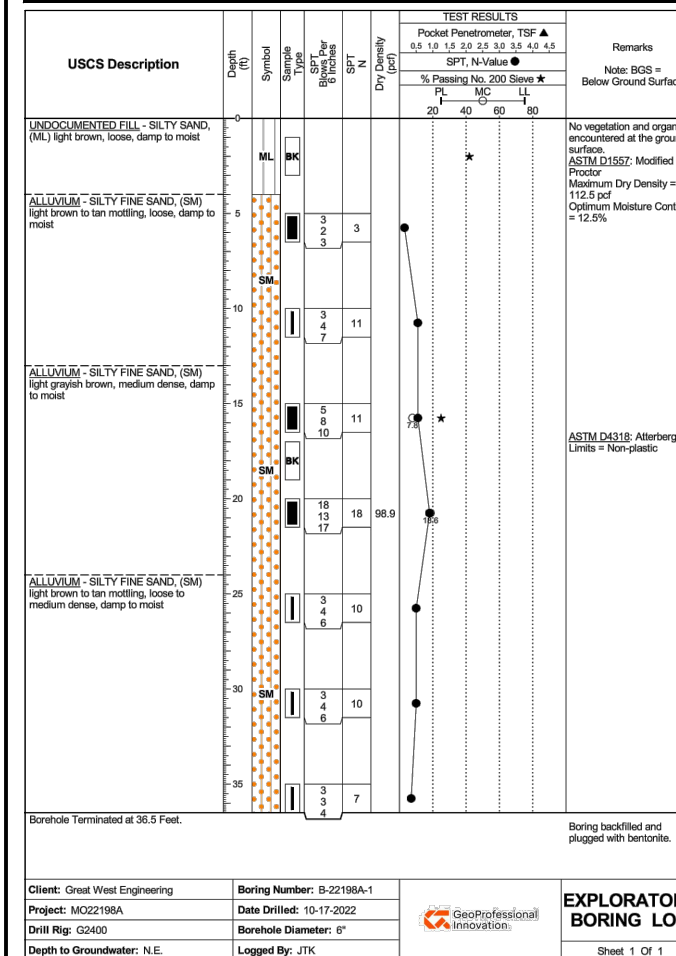
RING SAMPLE

## GROUNDWATER SYMBOLS

GROUNDWATER AFTER 24 HOURS

GROUNDWATER AT TIME OF DRILLING

GROUNDWATER AT THE END OF DRILLING



ISSUED FOR  
DESIGN USE  
PRELIMINARY  
REVIEW  
YOUR APPROVAL  
REFERENCE  
CONSTRUCTION  
DESTRUCTION  
PREVIOUS PRINTS

REV DATE DESCRIPTION  
11/2/22 SUMMARY  
12/20/22 60% DRAFT  
2/1/23 90% DRAFT  
2/15/23 FINAL

CHECK: TWJ  
FILE: MO22198A  
PROJECT:  
BONNER COUNTY WASTE  
TRANSFER FACILITY  
GEO-TECHNICAL ENGINEERING  
EVALUATION  
119 COLBURN CULVER ROAD  
BONNER COUNTY, IDAHO

DRAWN: JBM  
DESIGN: JBM  
PREPARED FOR:  
GREAT WEST ENGINEERING  
3050 N LAKE HARBOR LN  
BOISE, ID 83703  
ATTN:  
MR. TRAVIS PYLE, P.E.





## EXPLORATION LOGS

USCS Description	Depth (ft)	Symbol	Sample Type	SPT Blows Per 6 inches	SPT N	Dry Density (pcf)	TEST RESULTS			Remarks
							Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			
							SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL			
UNDOCUMENTED FILL - SILTY SAND, (SM) light brown, loose, damp to moist	0	SM								No vegetation and organics encountered at the ground surface.
ALLUVIUM - SILT WITH SAND, (ML) light grayish brown, loose, damp to moist	5	ML		13	17					
ALLUVIUM - SILTY FINE SAND, (SM) brown to tan mottling, loose, damp to moist	10	SM		13	17					
Borehole Terminated at 16.5 Feet.	15			4	7					Boring backfilled and plugged with bentonite.
Client: Great West Engineering							Boring Number: B-22198A-2		EXPLORATORY BORING LOG	
Project: MO22198A							Date Drilled: 10-17-2022		Sheet 1 Of 1	
Drill Rig: G2400							Borehole Diameter: 6"		GeoProfessional Innovation	
Depth to Groundwater: N.E.							Logged By: JTK			

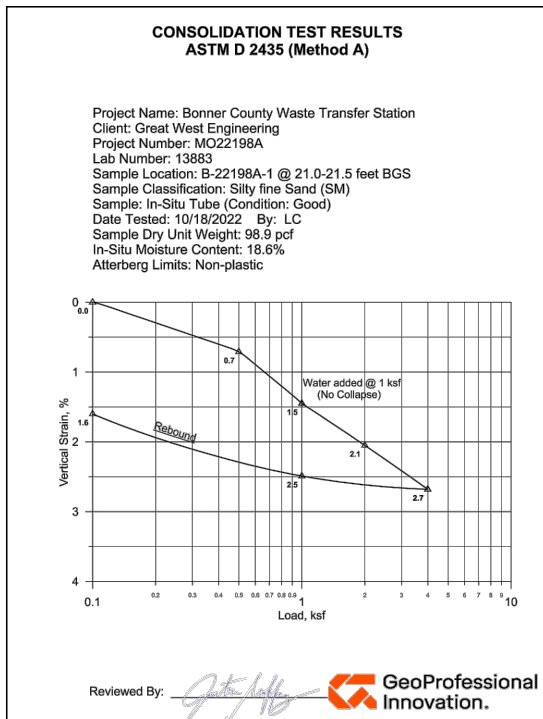
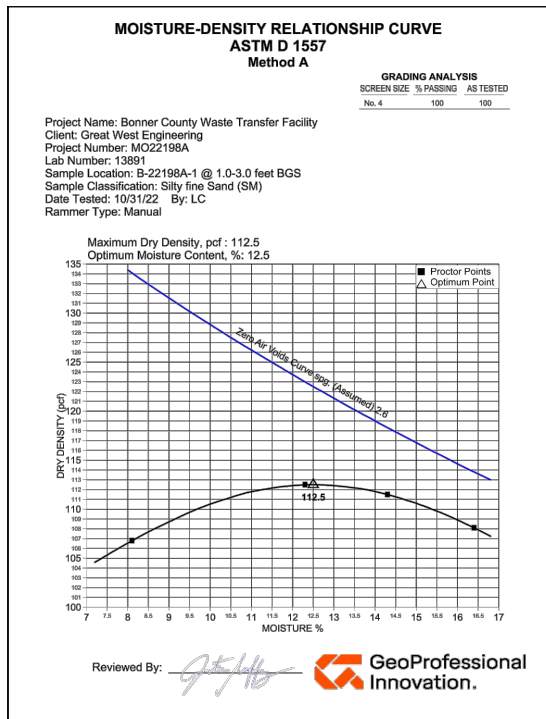
USCS Description	Depth (ft)	Symbol	Sample Type	SPT Blows Per 6 inches	SPT N	Dry Density (pcf)	TEST RESULTS			Remarks
							Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			
							SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL			
UNDOCUMENTED FILL - SILTY SAND, (SM) light brown, loose, damp to moist	0	SM								No vegetation and organics encountered near the ground surface.
ALLUVIUM - SILT WITH SAND, (ML) light grayish brown, medium dense, damp to moist	5	ML		13	17					SM 4500-H+ B: pH = 6.7 SM 2510 B: Resistivity = 25,000 ohm-cm SM-4500 SO4 E: Sulfates = 3.8 ppm
ALLUVIUM - SILTY FINE SAND, (SM) brown with tan mottling, loose, damp to moist	10	SM		13	17					
Borehole Terminated at 26.5 Feet.	15			8	8					Boring backfilled and plugged with bentonite.
Client: Great West Engineering							Boring Number: B-22198A-3		EXPLORATORY BORING LOG	
Project: MO22198A							Date Drilled: 10-17-2022		Sheet 1 Of 1	
Drill Rig: G2400							Borehole Diameter: 6"		GeoProfessional Innovation	
Depth to Groundwater: N.E.							Logged By: JTK			

USCS Description	Depth (ft)	Symbol	Sample Type	SPT Blows Per 6 inches	SPT N	Dry Density (pcf)	TEST RESULTS			Remarks
							Pocket Penetrometer, TSF ▲ 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5			
							SPT, N-Value ● % Passing No. 200 Sieve ★ PL MC LL			
ASPHALT PAVEMENT (6.0")	0	GP								No vegetation and organics encountered near the ground surface.
BASE COURSE - POORLY GRADED GRAVEL, (GP) gray, medium dense, damp (4.5")	5	GP		3	7					
UNDOCUMENTED FILL - SILTY SAND, (SM) light brown, loose, damp to moist	10	SM		2	5					
ALLUVIUM - SILTY FINE SAND, (SM) brown to light brown, loose, moist	15			2	7					Boring backfilled and plugged with bentonite.
Client: Great West Engineering							Boring Number: B-22198A-4		EXPLORATORY BORING LOG	
Project: MO22198A							Date Drilled: 10-17-2022		Sheet 1 Of 1	
Drill Rig: G2400							Borehole Diameter: 6"		GeoProfessional Innovation	
Depth to Groundwater: N.E.							Logged By: JTK			

## LABORATORY TEST RESULTS

Test Results Summary										
Boring	Depth	Lab	Description	In situ	In situ Dry	Max Dry	Optimum	Atterberg	#200 Sieve	Resistivity
B	(feet)	Number	(U.S.C.S. Classification)	Moisture, %	Density, pcf	Density, pcf	Moisture, %	Limits, %	Passing, %	Ω-cm
B-22198A-1	1.0-3.0	13885	Undocumented Fill - Silty Sand (SM)	14.7	-	112.5	12.5	-	42	-
B-22198A-1	17.0-19.0	13884	Alluvium - Silty Fine Sand (SM)	7.8	-	-	-	Non-plastic	25	-
B-22198A-1	21.0-21.5	13883	Alluvium - Silty Fine Sand (SM)	18.6	98.9	-	-	-	-	-
B-22198A-2	10.0-11.5	13886	Alluvium - Silty Fine Sand (SM)	3.7	-	-	-	-	-	-
B-22198A-3	5.5-6.0	13890	Alluvium - Silt with Sand (ML)	21.8	103.9*	-	-	-	-	6.7
B-21198A-3	25.0-26.5	13888	Alluvium - Silty Fine Sand (SM)	7.1	-	-	-	-	-	25,000
B-21198A-4	5.0-6.5	13889	Alluvium - Silty Fine Sand (SM)	10.3	-	-	-	-	-	3.6

\* SUSPECTED SAMPLE DISTURBANCE



ISSUED FOR:  
DESIGN USE  
PRELIMINARY  
REVIEW  
YOUR APPROVAL  
REFERENCE  
CONSTRUCTION  
DESTRUCTION  
PREVIOUS PRINTS

REV	DATE	DESCRIPTION	CHECK: TW
1	11/2/22	SUMMARY	FILE: MO22198A
2	12/20/22	60% DRAFT	PROJECT:
3	2/1/23	90% DRAFT	BONNER COUNTY WASTE
4	2/15/23	FINAL	TRANSFER FACILITY
			GEOTECHNICAL ENGINEERING
			EVALUATION
			119 COLBURN CUIVER ROAD
			BONNER COUNTY, IDAHO

DESIGN: JBM  
PREPARED FOR:  
GREAT WEST ENGINEERING  
3050 N LAKE HARBOR LN  
BOISE, ID 83703  
ATTN:  
MR. TRAVIS PYLE, P.E.

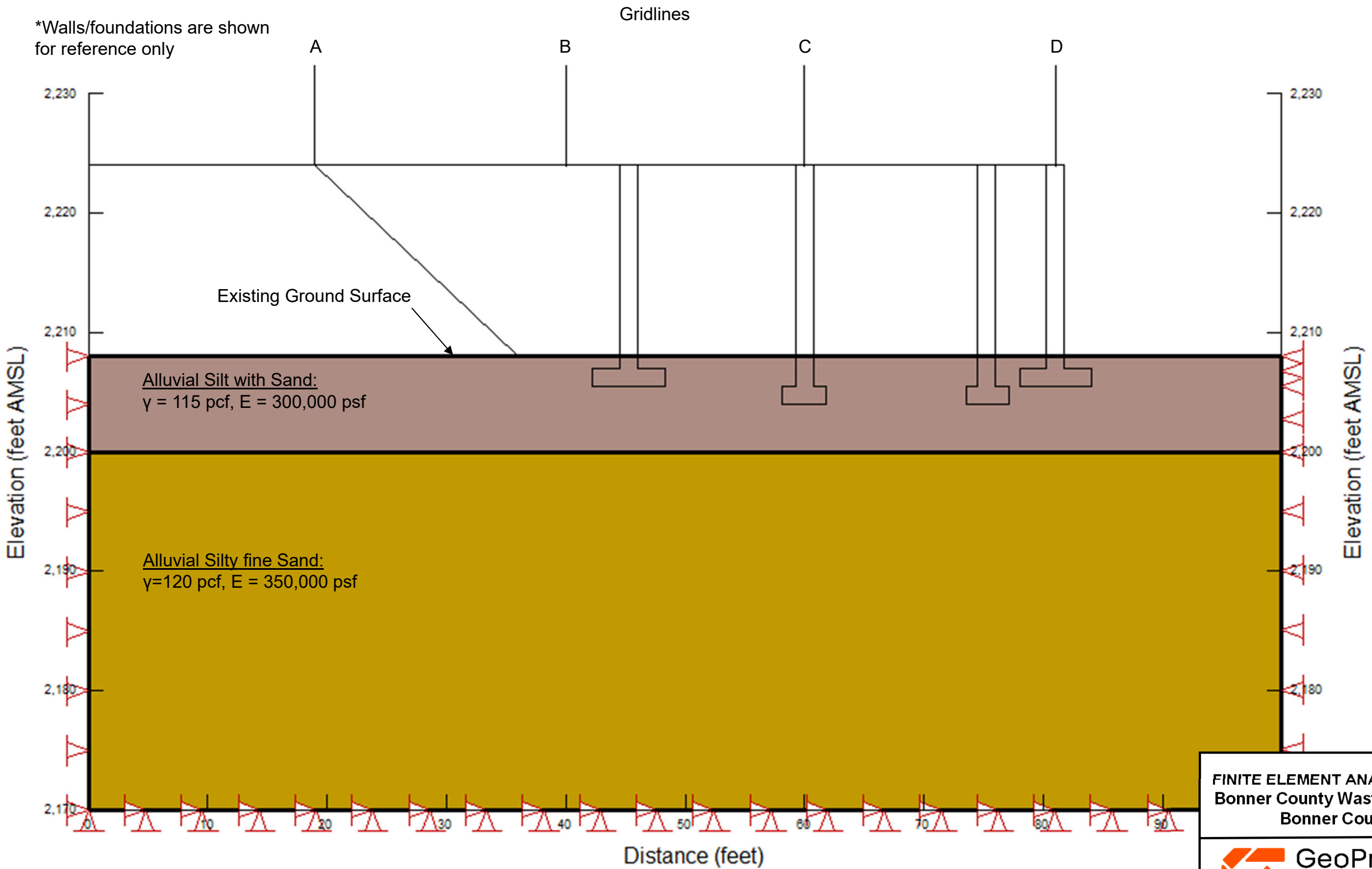
2-15-2023  
[Signature]  
[Stamp]

GeoProfessional  
Innovation®  
60 Donnell Road Pullman, WA 99163 509.339.2000

# **APPENDIX A**

## **Finite Element Analysis**

**Bonner County Waste Transfer Facility**  
**Finite Element Analysis – Existing Conditions & Geometry**



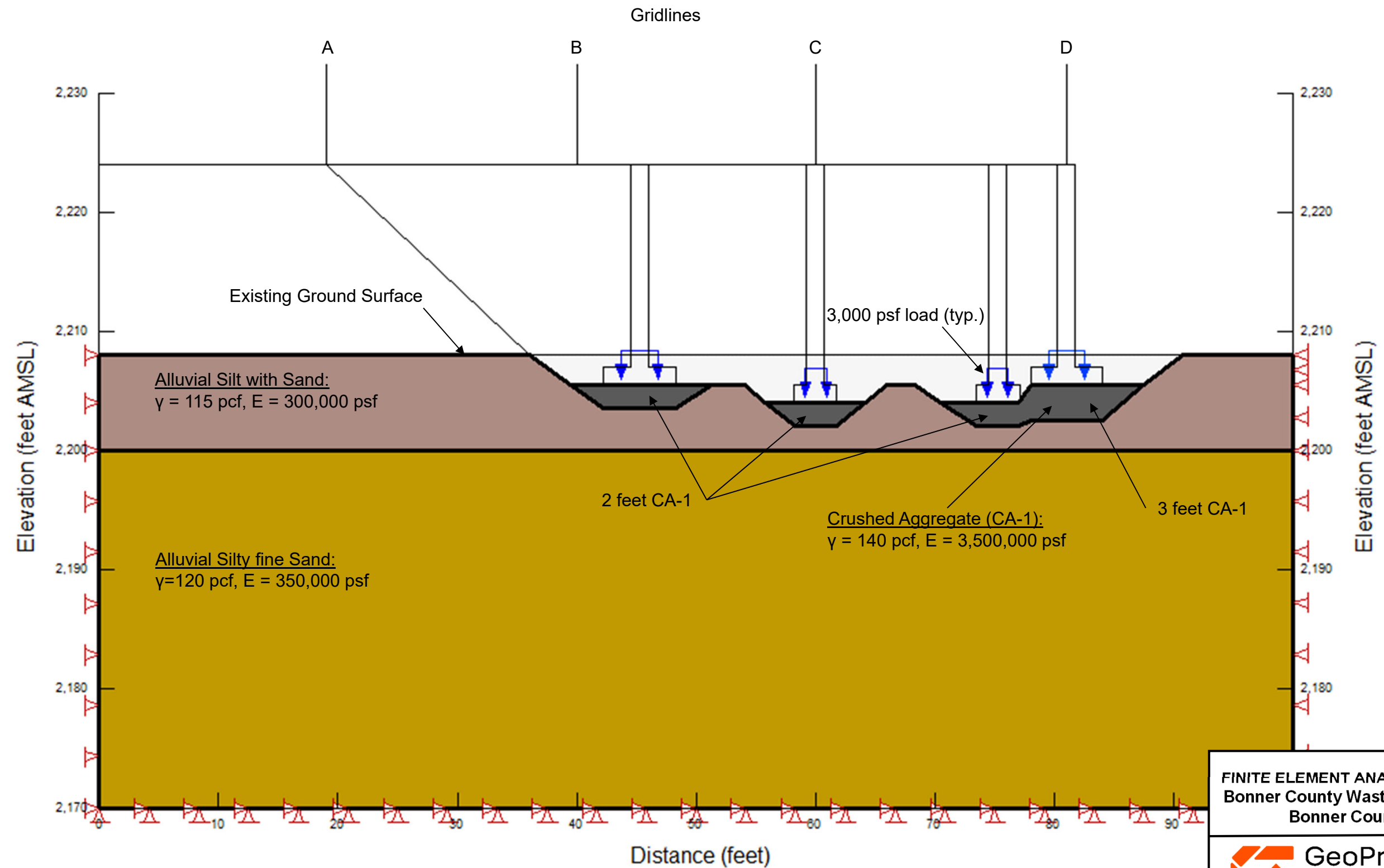
FINITE ELEMENT ANALYSIS GEOMETRY  
Bonner County Waste Transfer Facility  
Bonner County, Idaho



MO22198A

FIGURE A.1

**Bonner County Waste Transfer Facility**  
**Finite Element Analysis – Granular Soil Improvements Geometry**



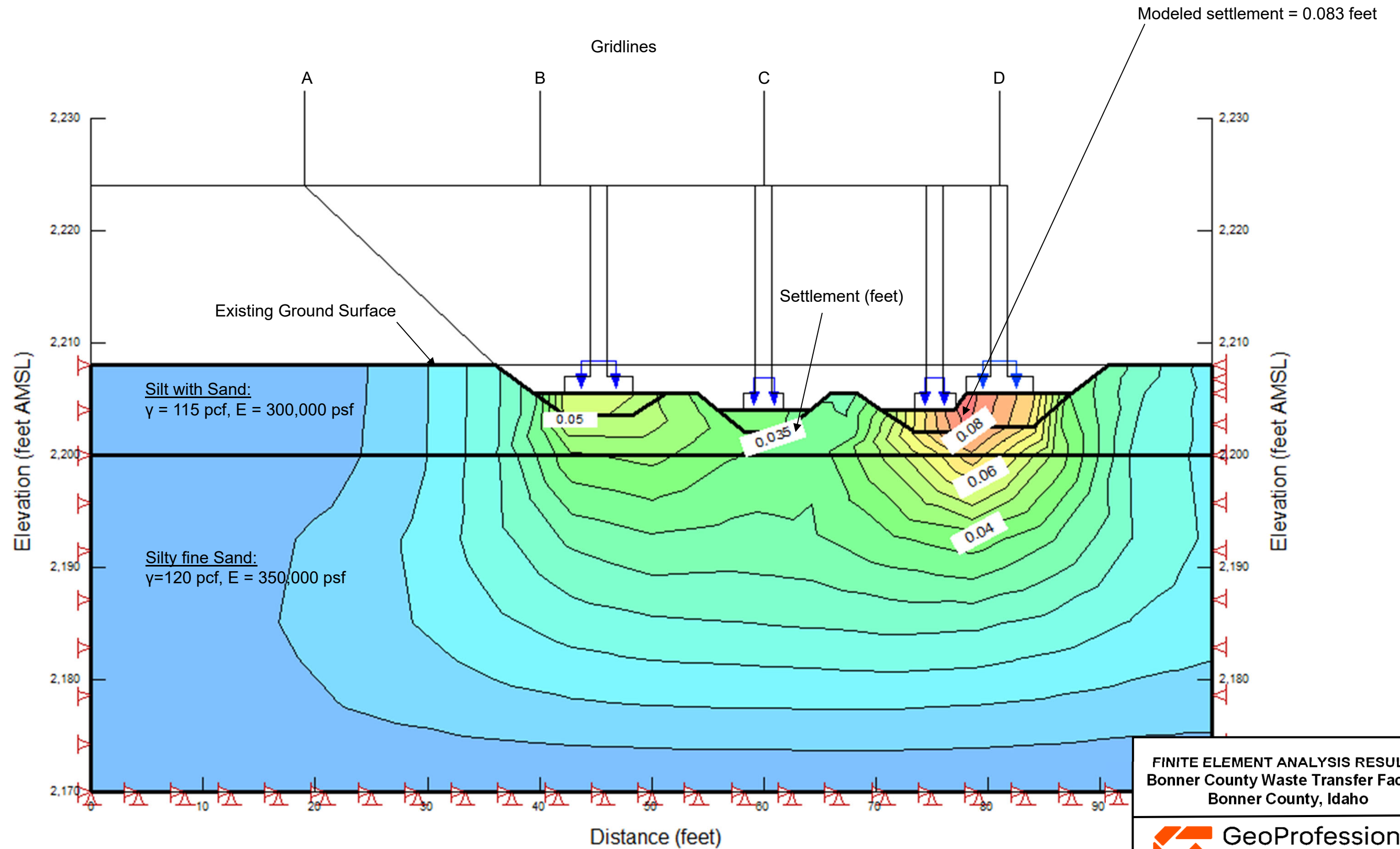
FINITE ELEMENT ANALYSIS GEOMETRY  
Bonner County Waste Transfer Facility  
Bonner County, Idaho

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Innovation.

MO22198A

FIGURE A.2

**Bonner County Waste Transfer Facility**  
**Finite Element Analysis – Settlement Estimates w/ Granular Soil Improvements**



FINITE ELEMENT ANALYSIS RESULTS  
Bonner County Waste Transfer Facility  
Bonner County, Idaho

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MO22198A

FIGURE A.3

# **APPENDIX 2**

## **TEMPORARY DISPOSAL SITE DRAWINGS**



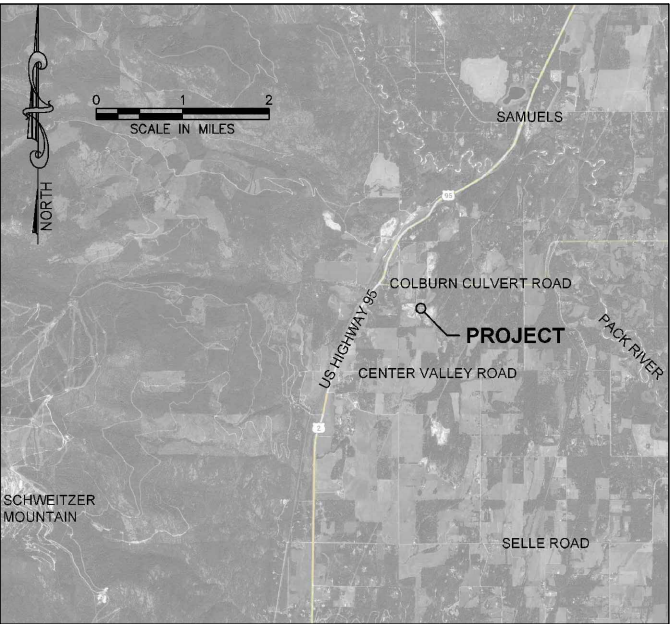
# COLBURN TEMPORARY DISPOSAL SITE

TOWNSHIP 58N, RANGE 1W SECTION 7  
PARCEL NO. RP58N01W074220A

- LINETYPE LEGEND**
- EXISTING REFUSE AREAS
  - PROPOSED LEASE AREA

**GENERAL NOTES:**

- AREAS AND DIMENSIONS SHOWN ARE APPROXIMATE. INFORMATION SHOWN IS BASED ON AERIAL PHOTOGRAPHY AND NOT SURVEY DATA.
- TEMPORARY REFUSE SITE TO BE IN PLACE NO LONGER THAN 24 MONTHS FROM THE MOMENT OF FIRST PUBLIC USE.



VICINITY MAP



OVERALL SITE PLAN

BY		REVISION		DATE	
#					

BONNER COUNTY  
ENGINEERING DEPARTMENT  
1500 HIGHWAY 2, SUITE 101  
SANDPOINT, IDAHO  
(208) 255-5681




SHEET TITLE: VICINITY MAP/OVERALL SITE PLAN  
PROJECT: COLBURN TEMPORARY WOOD/TIRE COLLECTION SITE  
WOOD'S COLBURN PIT  
BONNER COUNTY, ID

DATE: 7/27/22  
DRAWN BY: SJF  
CHECKED BY: BLS  
FILE NAME: TEMP SITE SCHEMATIC.dwg





DIMENSIONS SHOWN AREA APPROXIMATE. NO SURVEY DATA WAS COLLECTED FOR THIS PROJECT.

SHEET TITLE: <b>TEMPORARY WOOD AND TIRE COLLECTION SITE</b>		<b>BONNER COUNTY ENGINEERING DEPARTMENT 1500 HIGHWAY 2, SUITE 101 SANDPOINT, IDAHO (208) 255-5681</b>	
PROJECT: <b>WOOD'S COLBURN PIT BONNER COUNTY, ID</b>			
DATE:	7/27/22	#	DATE
DRAWN BY:	SJF		REVISION
CHECKED BY:	BLS		BY
FILE NAME:	TEMP SITE SCHEMATIC.dwg		
SHEET: <b>2</b> OF <b>2</b>			



# **APPENDIX 3**

## **EXISTING WTB DRAWINGS (Incomplete)**



# COLBURN TRANSFER STATION BONNER COUNTY, IDAHO CONSTRUCTION PLANS

SEPTEMBER 1993

ISSUED FOR CONSTRUCTION

PREPARED FOR:

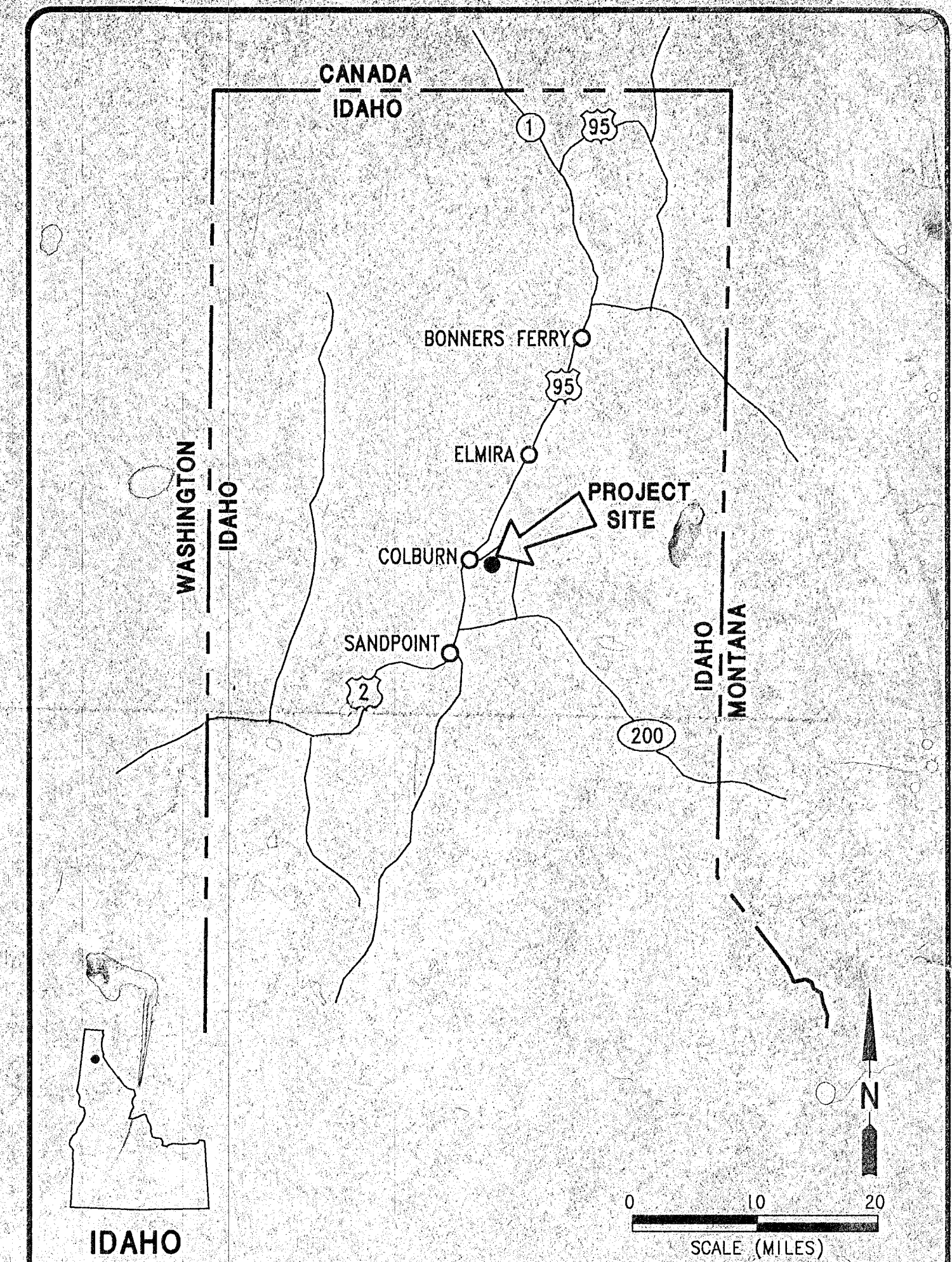
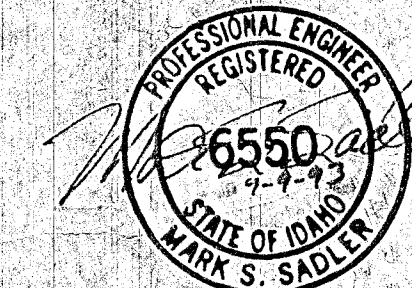
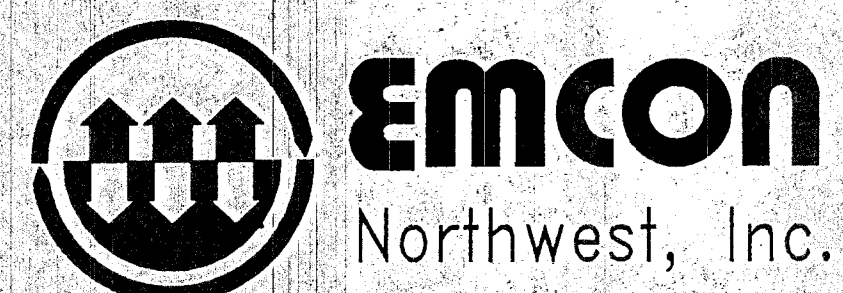
BONNER COUNTY BOARD OF COMMISSIONERS

EUGENE BROWN

SUSAN MacLEOD

WAYNE NEWCOMB

PREPARED BY:



LOCATION MAP

## DRAWING INDEX

DRAWING NUMBER	TITLE AND DESCRIPTION	LATEST REVISION NUMBER	LATEST REVISION DATE
	COVER SHEET	1	10-1-93
1	ABBREVIATIONS & LEGEND	1	10-1-93
2	SITE PLAN	1	10-1-93
3	ROAD PROFILE AND SECTION	1	10-1-93
4	BUILDING AND FOUNDATION PLAN	1	10-1-93
5	BUILDING SECTIONS & DETAILS	1	10-1-93
6	BUILDING ELEVATIONS	1	10-1-93
7	ELECTRICAL PLAN & DETAILS	1	10-1-93

APPROVED:

*Mark S. Sadler*  
PROJECT MANAGER

9-9-93  
DATE

*John M. Gaid*  
ENGINEERING MANAGER

9-9-93  
DATE



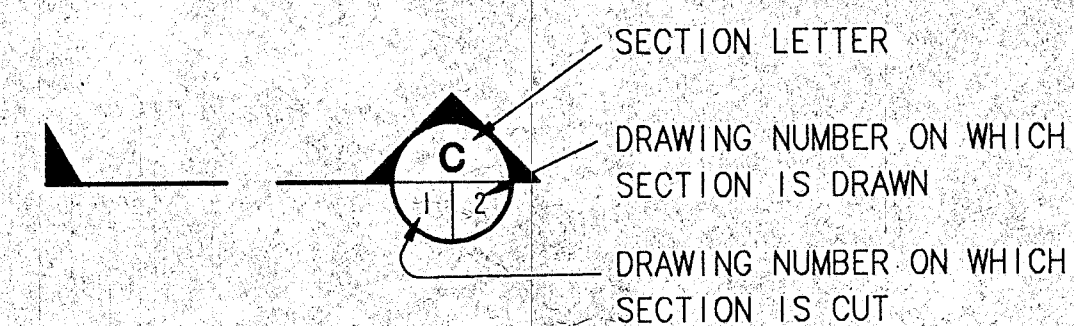
## ABBREVIATIONS:

& APPROX. /~ ASPH. @	AND APPROXIMATELY ASPHALT AT
BVC BLDG.	BEGIN VERTICAL CURVE BUILDING
CL C CMP CY	CENTERLINE CHANNEL CORRUGATED METAL PIPE CUBIC YARD
Δ DESC. DIA. / Ø DET. DWG. D.I.	DEFLECTION ANGLE DESCRIPTION DIAMETER DETAIL DRAWING DUCTILE IRON
E EA. EL. ELL EVC EXIST.	EASTING EACH ELEVATION PVC ELBOW END VERTICAL CURVE EXISTING
F.B. F.L. FT. /'	FLAT BAR FLOW LINE FOOT
G.B. GALV	GRADE BREAK GALVANIZED
H.P. HORIZ.	HIGH POINT HORIZONTAL
I.D. IN. /" INT I.E.	INSIDE DIAMETER INCH INTERSECTION INVERT ELEVATION
L L.F. LG. L.P.	LENGTH OF CURVE/ANGLE IRON LINEAR FEET LONG LOW POINT
MH (MAX) (MIN)	MANHOLE MAXIMUM MINIMUM
N NO. /# NTS N.I.C.	NORTH/NORTHING NUMBER NOT TO SCALE NOT IN CONTRACT
O.C.	ON CENTER
% PL P.C. P.I. P.T. P.S. PVC	PERCENT PLATE POINT OF CURVE POINT OF INTERSECTION POINT OF TANGENT PUMP STATION POLYVINYL CHLORIDE
R REF. REQ'D.	RADIUS REFERENCE REQUIRED
SCH/SCHED. S	SCHEDULE SOUTH

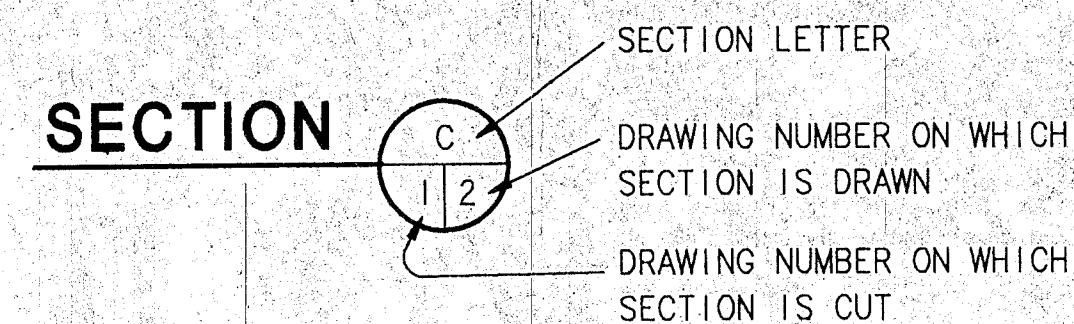
STA STL	STATION STEEL
TEMP. (TYP)	TEMPORARY TYPICAL
VC	VERTICAL CURVE
W/	WITH

## SECTION INDICATOR:

DRAWING ON WHICH SECTION IS CUT:

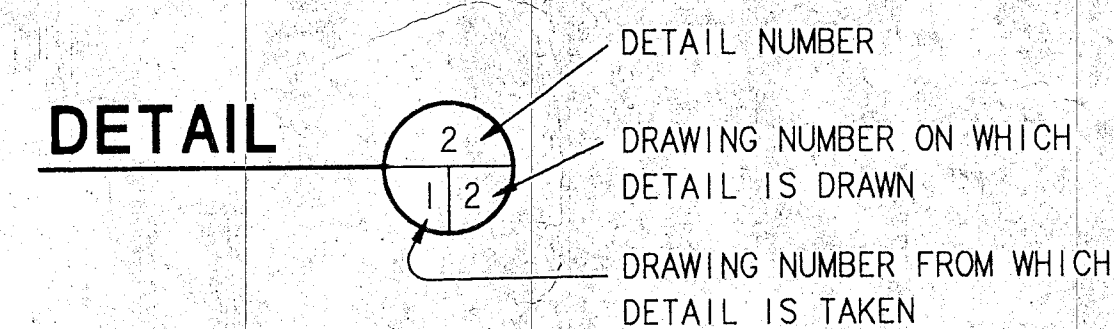


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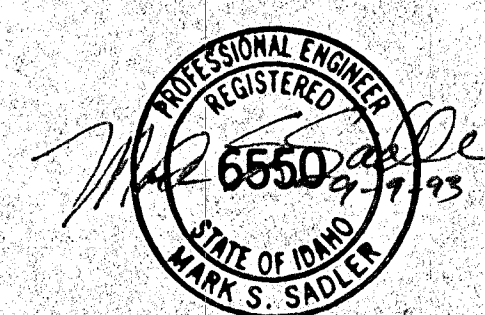
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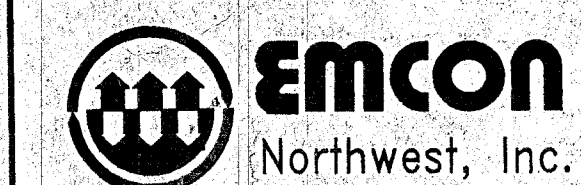


## ABBREVIATIONS:

	EXISTING FENCE
	EXISTING CONTOUR
	EXISTING GRAVEL ROAD
	EXISTING WATER
	EXISTING POWER
	EXISTING TELEPHONE
	EXISTING WATER MANHOLE W/ METER
	EXISTING POWER POLE
	EXISTING MONITORING WELL
	FENCE
	ASPHALT PAVED ROAD
	SLOPE DESIGNATION
	TYPICAL STORMWATER DRAINAGE DITCH CENTERLINE
	BUILDING
	CATCH BASIN
	TELEPHONE/POWER RISER
	POWER
	WATER (POTABLE)
	PROCESS WATER
	TELEPHONE
	TRANSVERSE DRAINAGE STRUCTURE
	GRADE
	RETAINING WALL



REV	DATE	DESCRIPTION	DES BY	CHK BY	APP BY
1	10/1/93	ISSUED FOR CONSTRUCTION	THC	THC	J.B. DAVIS
0	9/9/93	ISSUED FOR BLDG PERMIT	THC	THC	J.B. DAVIS
DATE OF ISSUE	DES BY	SDS	CHK BY	APP BY	
9/9/93	THC	THC	THC	THC	

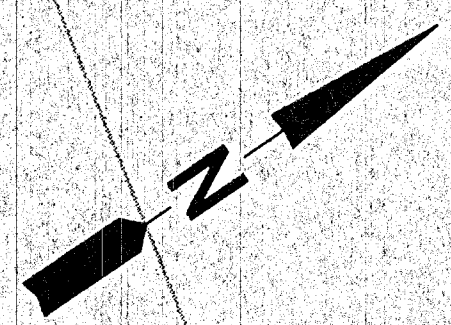


COLBURN TRANSFER STATION  
BONNER COUNTY, IDAHO

CONSTRUCTION PLANS  
ABBREVIATIONS AND LEGEND

DRAWING NO  
**1**  
PROJECT NO  
0807-001.02





END ROAD N2  
CONSTRUCTION  
STA 5+82.46  
N 8316.69  
E 10753.99

OFFICE TRAILER  
(N.I.C.)

STUB-OUT FOR  
WATER CONN.

ECOLOGY BLOCK  
(TYP)

PI 1  
N 8180.22  
E 10739.61

PI 2  
N 8529.91  
E 10953.06

PI 3  
N 8740.53  
E 11050.24

PI 4  
N 8950.17  
E 11150.24

PI 5  
N 9160.31  
E 11250.24

PI 6  
N 9370.45  
E 11350.24

PI 7  
N 9580.59  
E 11450.24

PI 8  
N 9790.73  
E 11550.24

PI 9  
N 10000.87  
E 11650.24

PI 10  
N 10211.01  
E 11750.24

PI 11  
N 10421.15  
E 11850.24

PI 12  
N 10631.29  
E 11950.24

PI 13  
N 10841.43  
E 12050.24

PI 14  
N 11051.57  
E 12150.24

PI 15  
N 11261.71  
E 12250.24

PI 16  
N 11471.85  
E 12350.24

PI 17  
N 11681.99  
E 12450.24

PI 18  
N 11892.13  
E 12550.24

PI 19  
N 12102.27  
E 12650.24

PI 20  
N 12312.41  
E 12750.24

6' HIGH CHAIN-  
LINK FENCE

METER STAND &  
TRANSFORMER PAD  
SEE ELEC. NOTES

2" SDR 11 HDPE WATER PIPE

3" SDR 11 HDPE WATER PIPE

4" SDR 11 HDPE WATER PIPE

6" SDR 11 HDPE WATER PIPE

8" SDR 11 HDPE WATER PIPE

10" SDR 11 HDPE WATER PIPE

12" SDR 11 HDPE WATER PIPE

14" SDR 11 HDPE WATER PIPE

16" SDR 11 HDPE WATER PIPE

18" SDR 11 HDPE WATER PIPE

20" SDR 11 HDPE WATER PIPE

22" SDR 11 HDPE WATER PIPE

24" SDR 11 HDPE WATER PIPE

26" SDR 11 HDPE WATER PIPE

28" SDR 11 HDPE WATER PIPE

30" SDR 11 HDPE WATER PIPE

32" SDR 11 HDPE WATER PIPE

34" SDR 11 HDPE WATER PIPE

36" SDR 11 HDPE WATER PIPE

38" SDR 11 HDPE WATER PIPE

40" SDR 11 HDPE WATER PIPE

42" SDR 11 HDPE WATER PIPE

44" SDR 11 HDPE WATER PIPE

46" SDR 11 HDPE WATER PIPE

LANDSCAPE  
TIMBER STAIRS

HYDROSEED

EXISTING POWER POLE

EXISTING MANHOLE  
RIM EL 2219.58  
METER EL 2212.08

EXISTING MANHOLE  
RIM EL 2219.58  
METER EL 2212.08

EXISTING MANHOLE  
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EXISTING MANHOLE  
RIM EL 2219.58  
METER EL 2212.08

LOADED  
TRAILER  
PARKING

PUBLIC  
DROP  
AREA

GATE

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ROAD CENTERLINE HORIZONTAL CONTROL					
ROAD	CURVE	RADIUS	LENGTH	TANGENT	DELTA
N1	PI 1	100.00'	113.40'	63.68'	64°58'30"
N1	PI 2	300.00'	40.54'	20.30'	07°44'31"

LEGEND

- LIMIT OF ASPHALT CONCRETE  
PAVEMENT AND BASE COURSE
- LIMIT OF CRUSHED  
SURFACING
- 2 1/2" SCH 80 PVC CONDUIT FOR TELEPHONE
- WATER SUPPLY
- 2 1/2" SCH 80 PVC CONDUIT FOR POWER

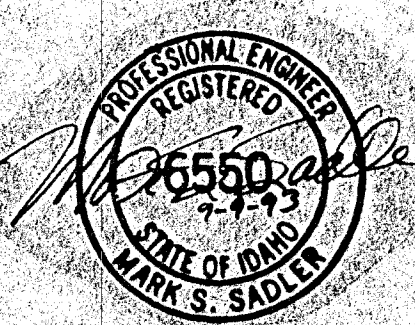
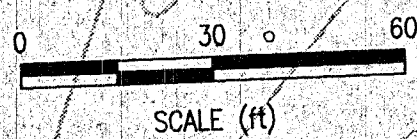
NOTES

- SEE DRAWING 7 FOR DUCT BANK AND  
ADDITIONAL ELECTRICAL WORK.
- INSTALL ELECTRICAL CONDUIT AND HANDHOLDS  
PER NORTHERN LIGHT COMPANY STANDARDS.
- SEE UTILITY TRENCH DETAIL, DRAWING 3.

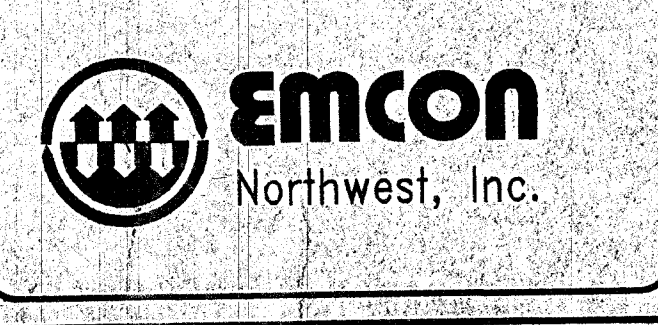
Topography prepared by  
David P. Evans and Associates.  
Date of Survey: July, 1992

BENCHMARK:  
SW CORNER OF GOVERNMENT  
LOT No 1 5/8" REBAR  
& CAP

EL = 2219.17



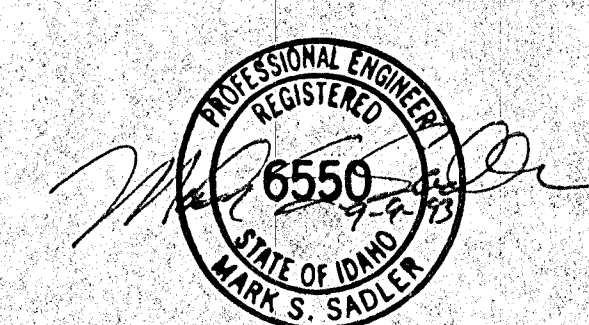
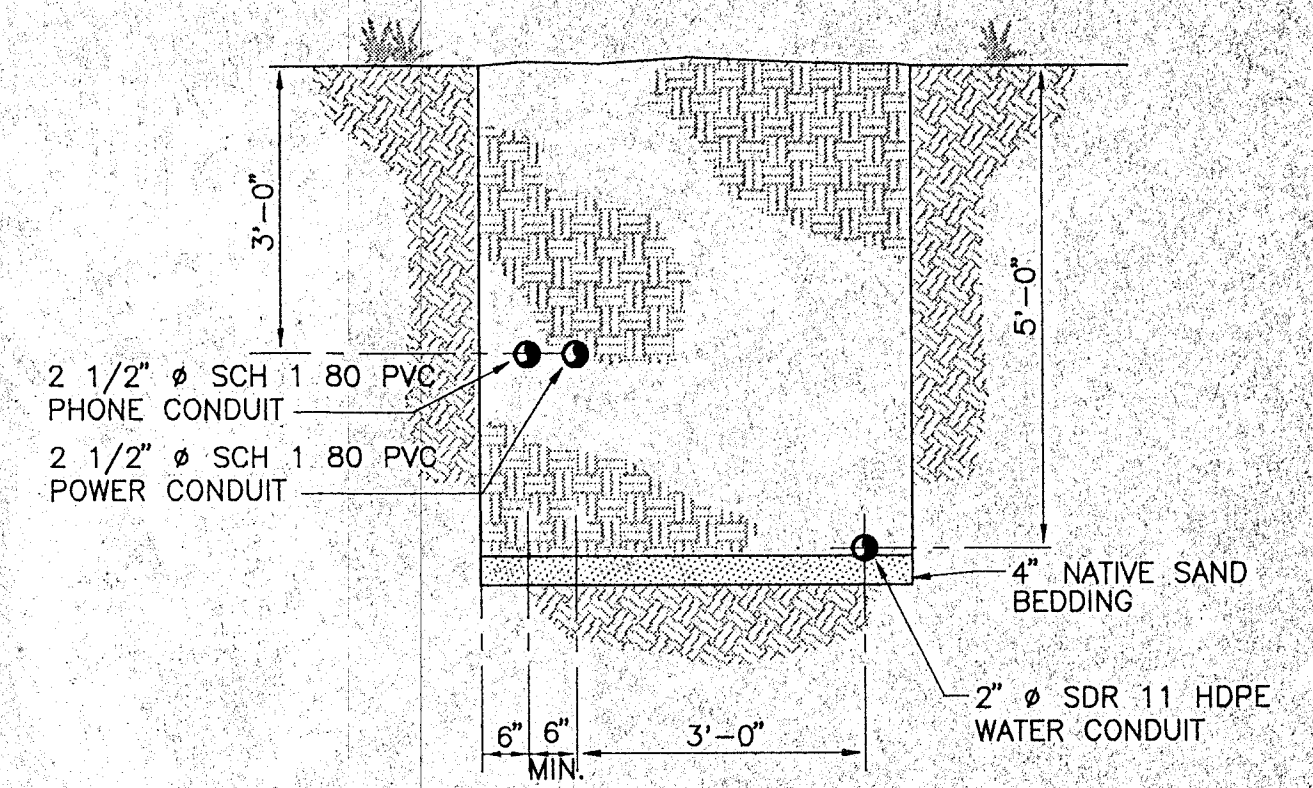
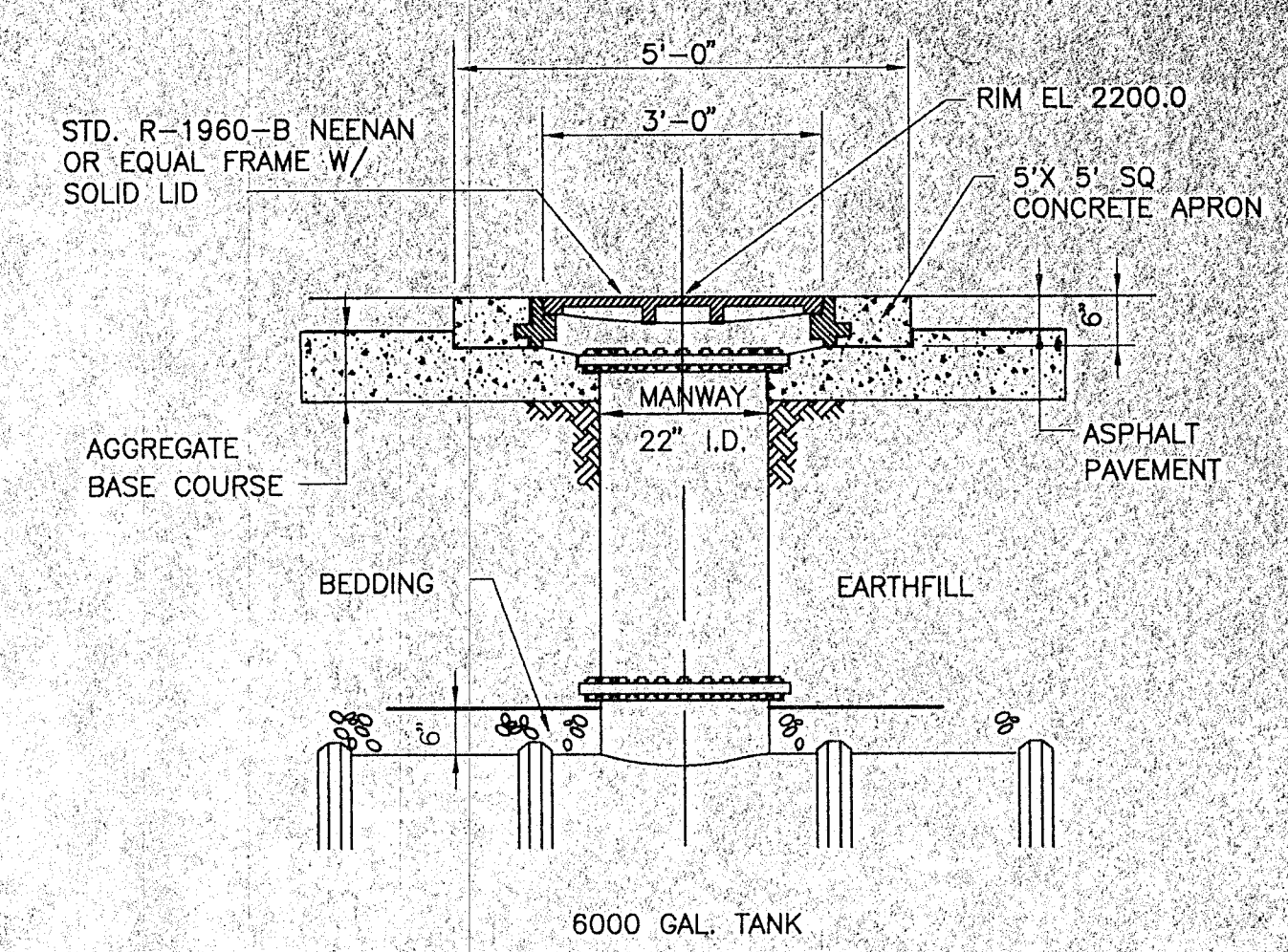
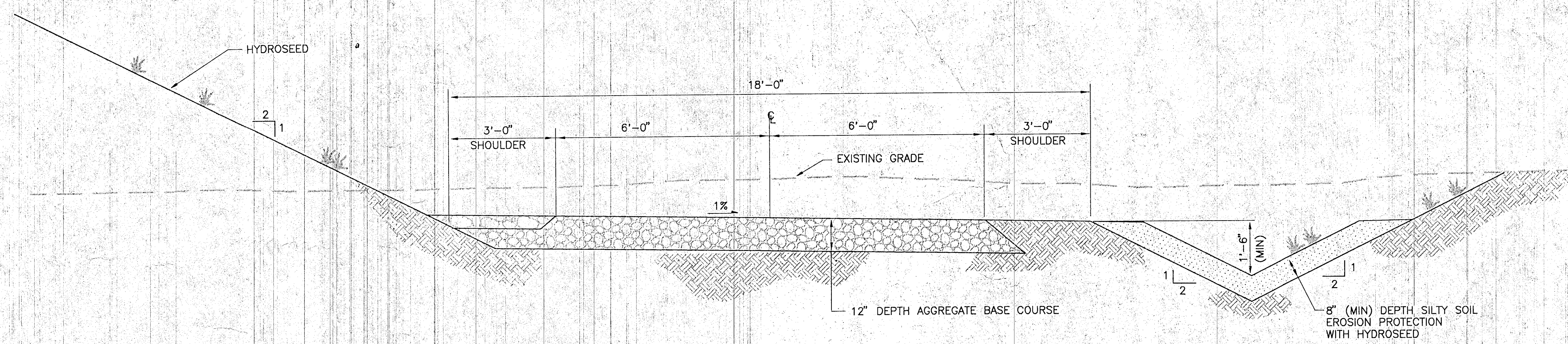
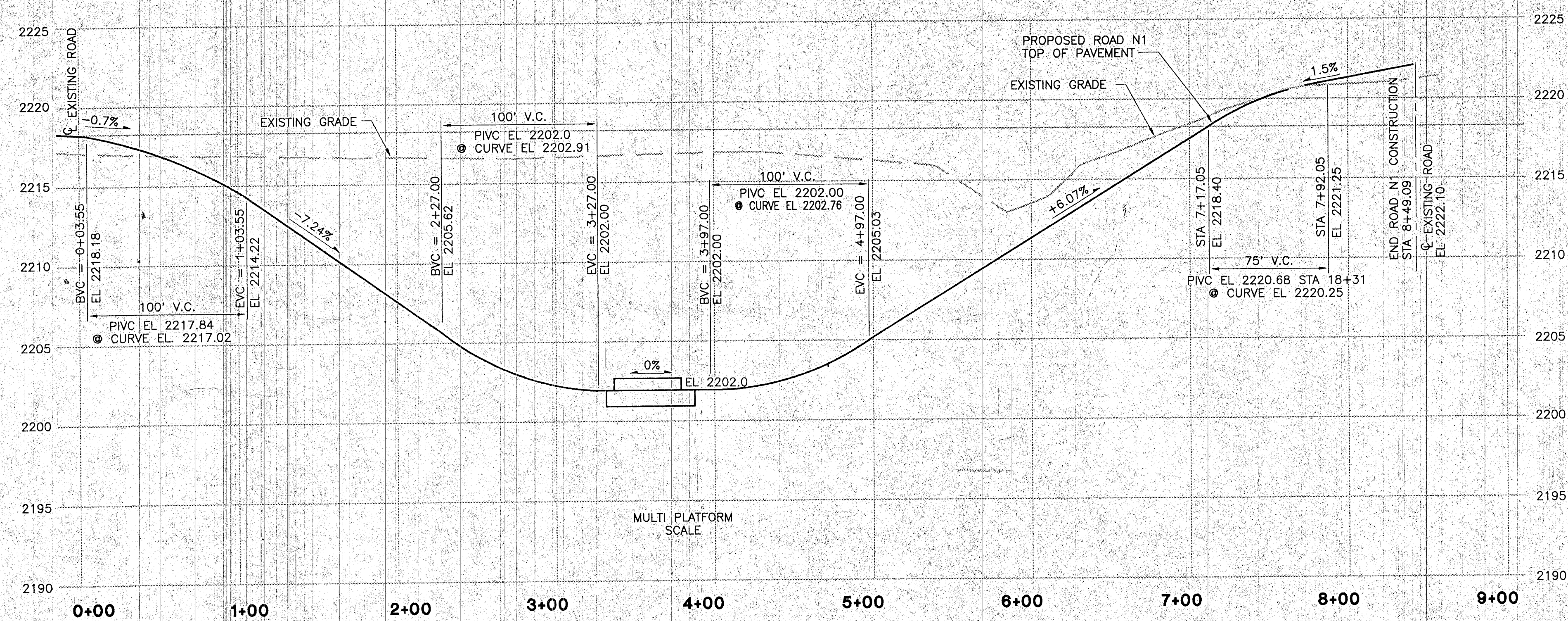
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1	10/1/93	ISSUED FOR CONSTRUCTION	MDC	MSS	J.B.	MSS
0	9/9/93	ISSUED FOR BLDG PERMIT	MDC	MSS	J.B.	MSS



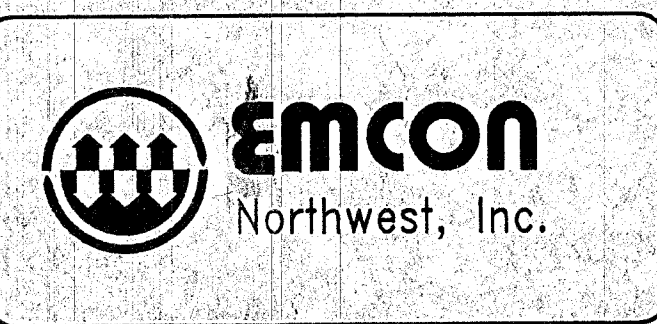
COLBURN TRANSFER STATION  
BONNER COUNTY, IDAHO  
CONSTRUCTION PLANS  
SITE PLAN

DRAWING NO  
2  
PROJECT NO  
0807-001.02





1	10/1/93	ISSUED FOR CONSTRUCTION	MR	MR	J.B.	MR			
0	9/9/93	ISSUED FOR BLDG PERMIT	MR	MR	J.B.	MR			
REV	DATE	DESCRIPTION	OWN BY	DES BY	CHK BY	APP BY			
DATE OF ISSUE	9/9/93	DWN BY	MDC	DES BY	CHK BY	APP BY			

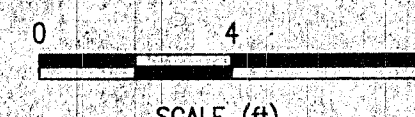
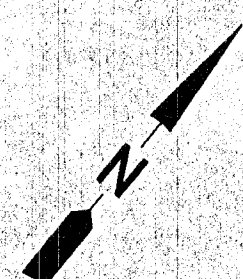


COLBURN TRANSFER STATION  
BONNER COUNTY, IDAHO

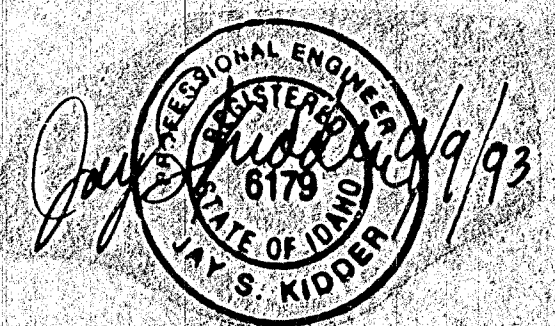
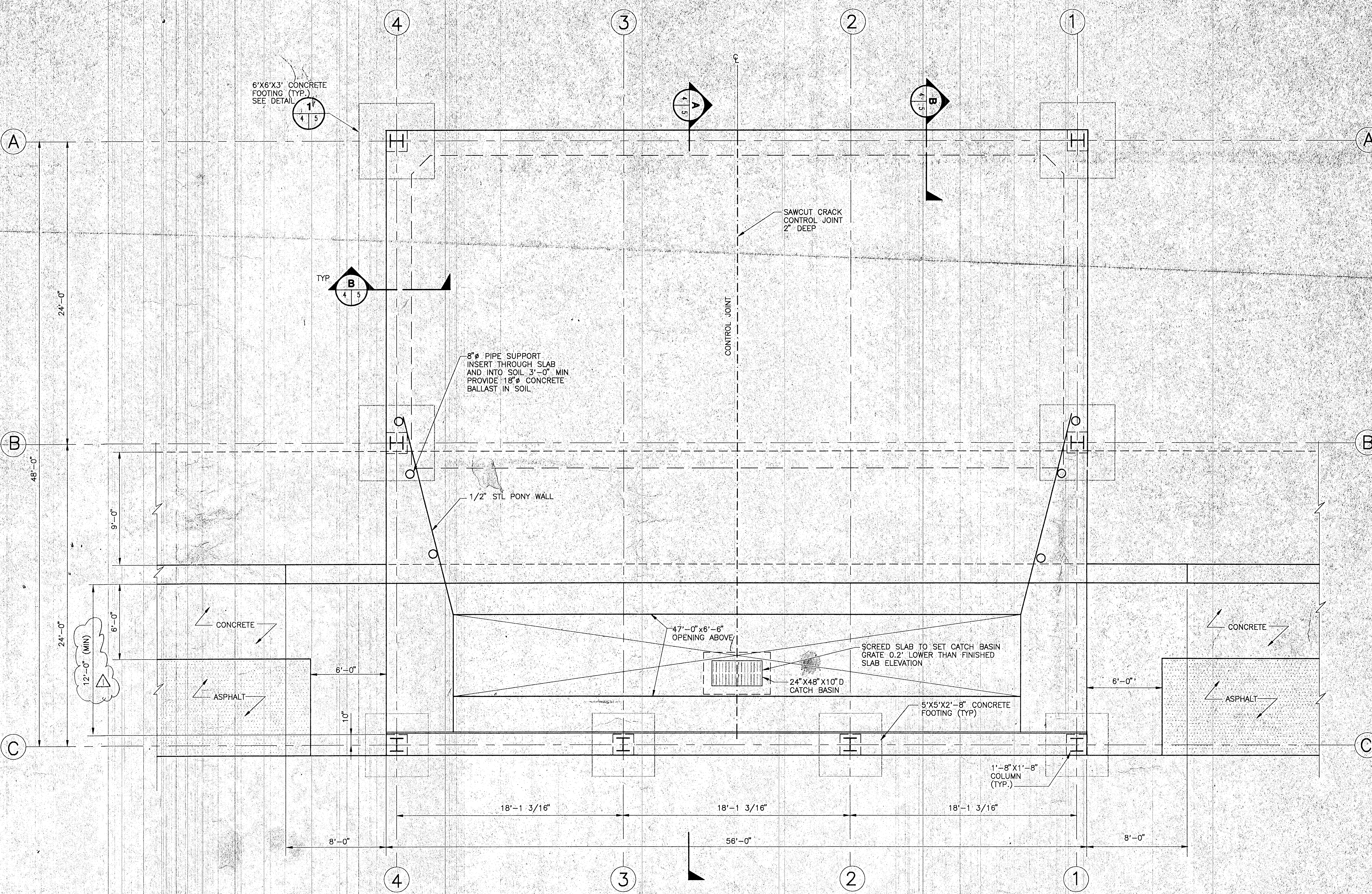
**CONSTRUCTION PLANS  
ROAD N1 PROFILE**

DRAWING NO  
**3**  
PROJECT NO  
0807-001.02





SCALE (ft)



**CHINOOK ENGINEERING**

1501 N. BOX 1244  
MUKILTEO, WASHINGTON 98275  
(360) 347-9873

PROFESSIONAL CONSULTING ENGINEERS

REV	DATE	DESCRIPTION	OWN BY	DES BY	CHK BY	APP BY
1	10/1/93	ISSUED FOR CONSTRUCTION	MDC	JSK	JB	JSK
0	9/9/93	ISSUED FOR BLDG PERMIT	MDC	JSK	JB	JSK
DATE OF ISSUE: 9/9/93			DWN BY: MDC	CHK BY: JB	APP BY: JSK	
			DES BY: JSK	APP BY: JSK		

**Emcon**  
Northwest, Inc.

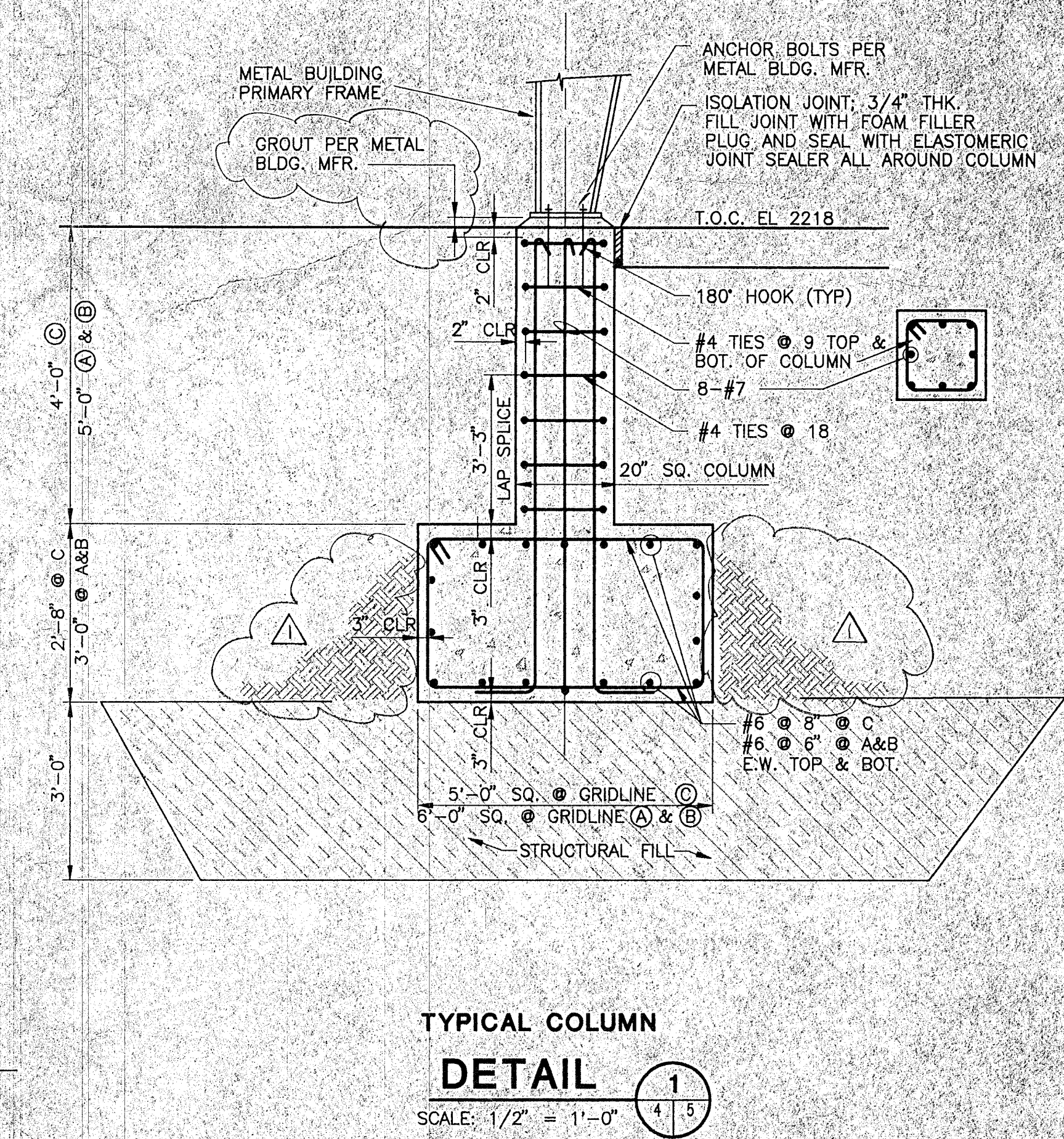
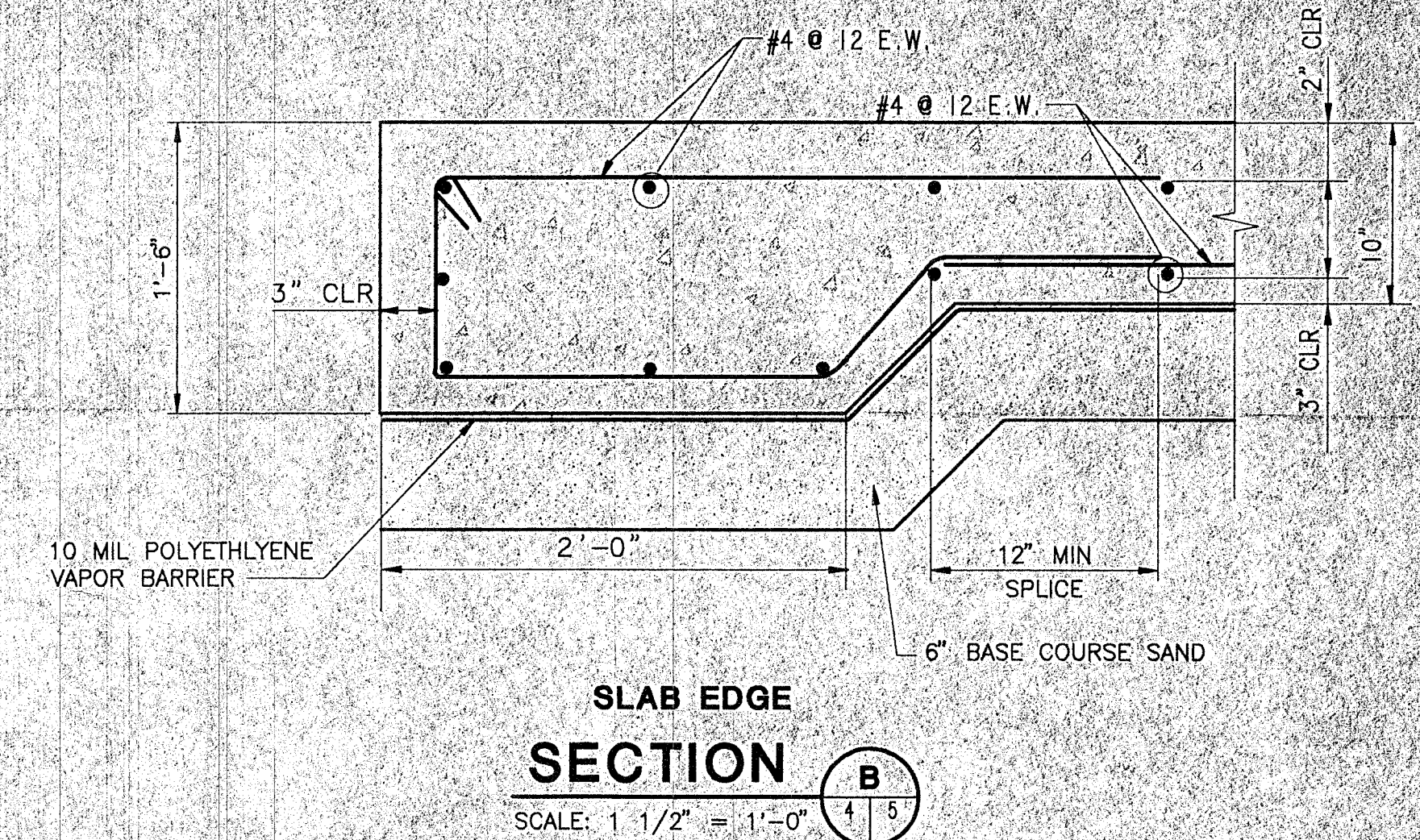
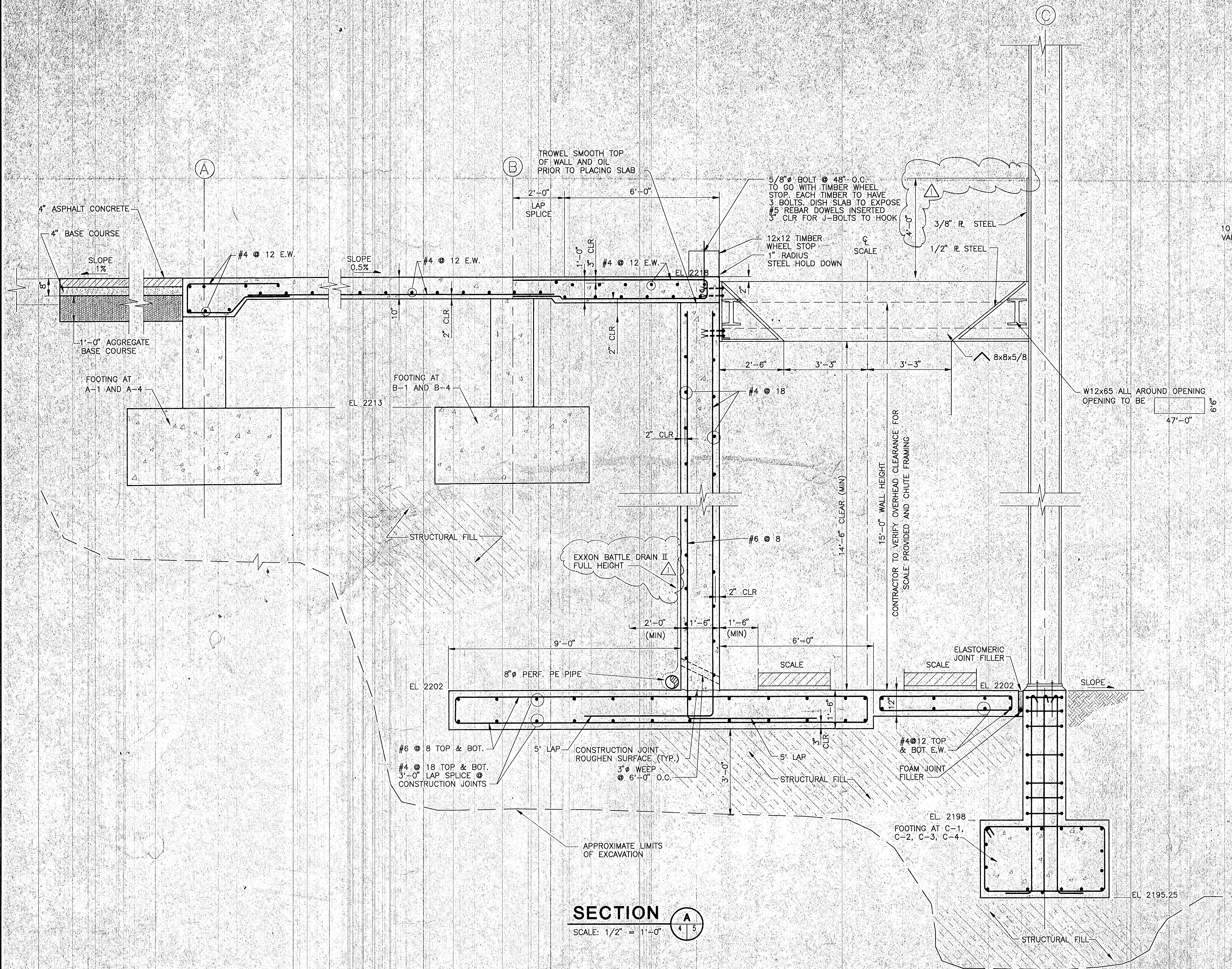
COLBURN TRANSFER STATION  
BONNER COUNTY, IDAHO

**CONSTRUCTION PLANS**  
**BUILDING FOUNDATION PLAN**

DRAWING NO.  
**4**

PROJECT NO.  
0807-001.02





PROFESSIONAL ENGINEER  
REGISTERED  
STATE OF IDAHO  
6179  
JAY S. KIDDER  
9/9/93

**CHINOOK ENGINEERING**  
P.O. BOX 1244  
MILFORD, WASHINGTON 98279  
(206) 347-9873  
PROFESSIONAL CONSULTING ENGINEERS

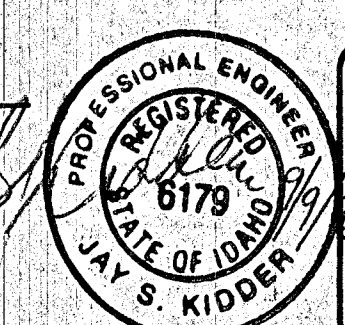
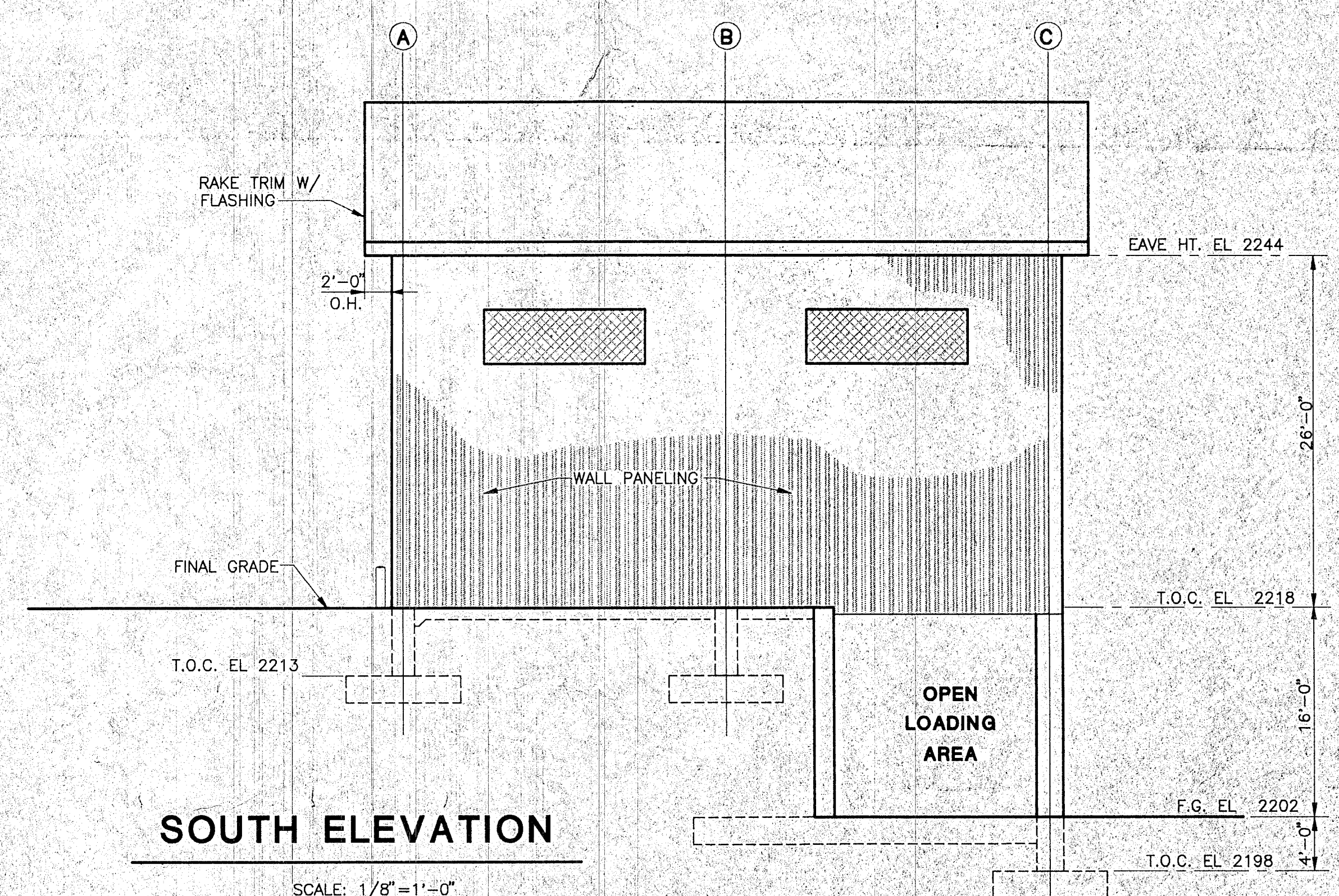
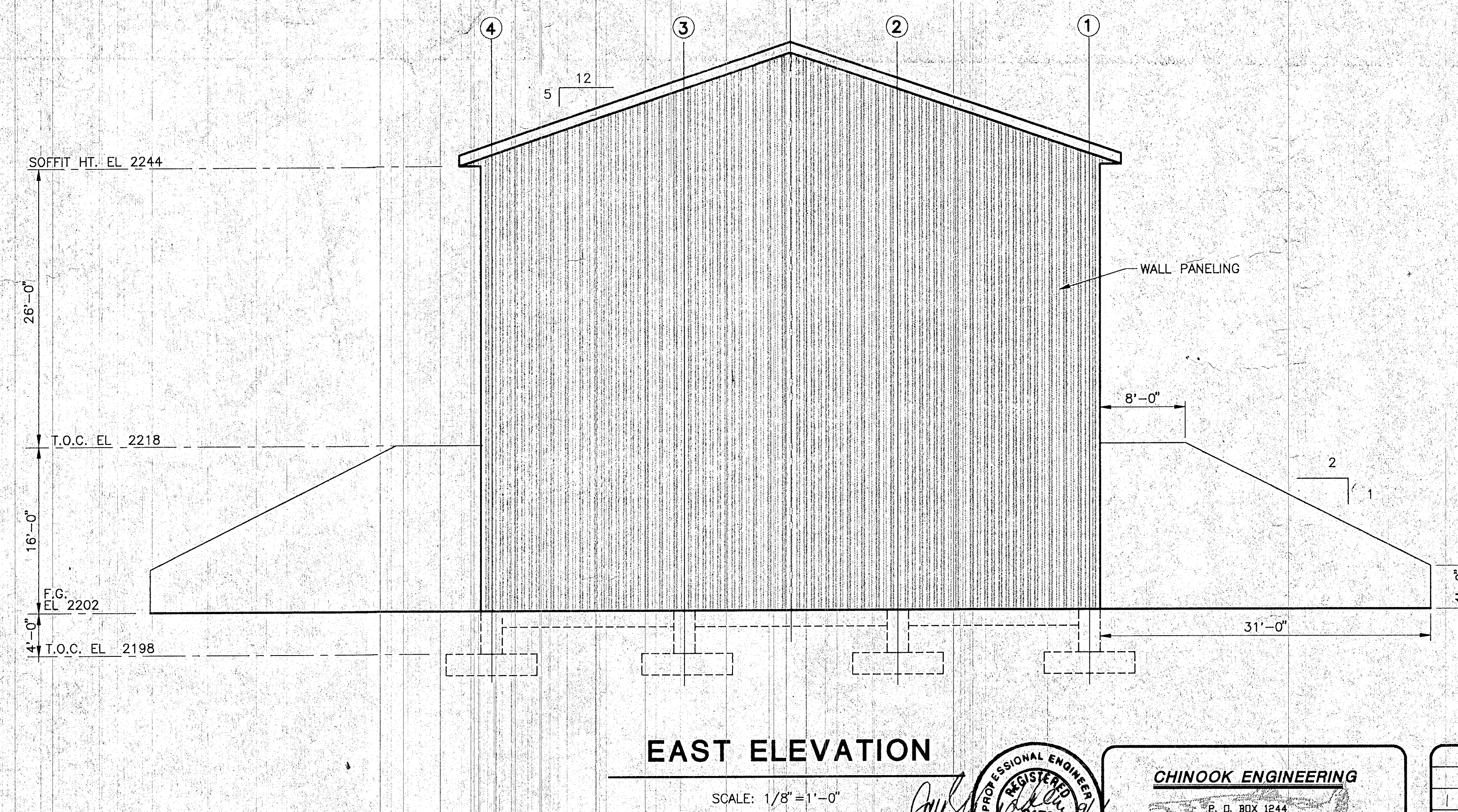
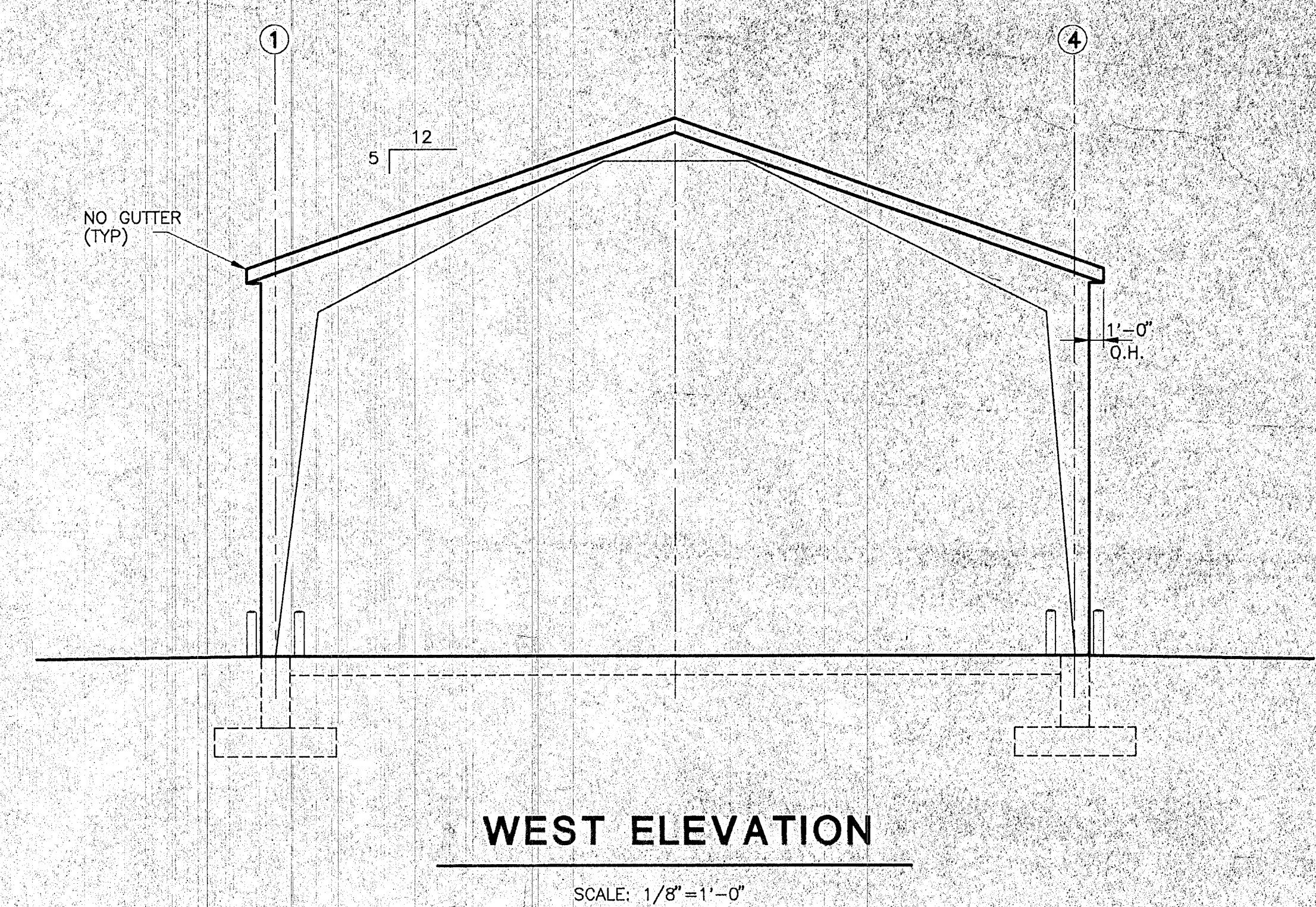
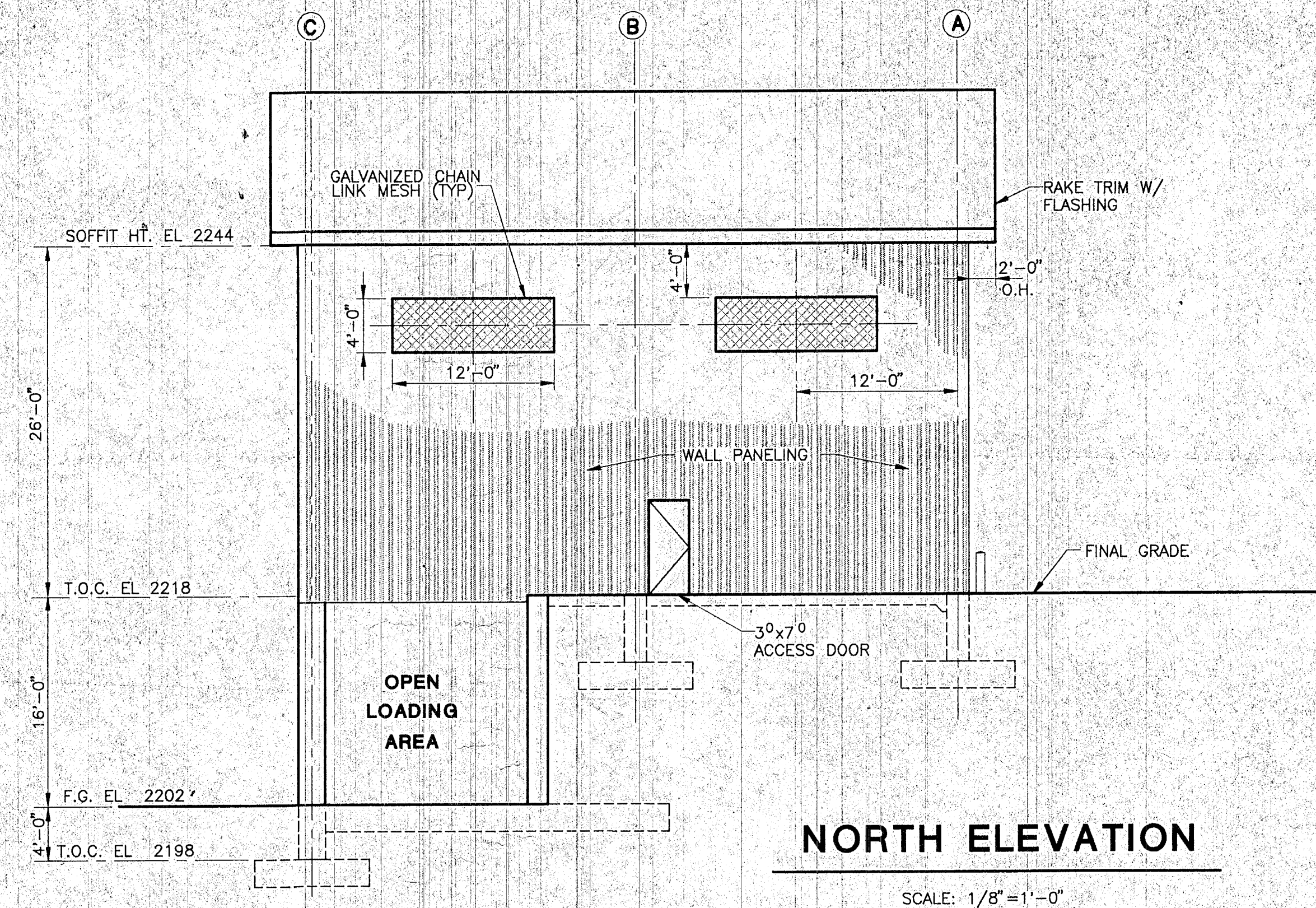
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0	9/9/93	ISSUED FOR BLDG PERMIT	MDC	JSK	JB	JSK			
REV	DATE	DESCRIPTION	OWN BY	DES BY	CHK BY	APP BY			
DATE OF ISSUE	9/9/93	OWN BY	MDC	DES BY	JSK	CHK BY	JB	APP BY	JSK

**emcon**  
Northwest, Inc.

COLBURN TRANSFER STATION  
BONNER COUNTY, IDAHO  
**CONSTRUCTION PLANS**  
**BUILDING SECTIONS AND DETAILS**

DRAWING NO  
**5**  
PROJECT NO  
0807-001.02





**CHINOOK ENGINEERING**  
P. O. BOX 1244  
MUKILTEO, WASHINGTON 98275  
(206) 347-9873  
PROFESSIONAL CONSULTING ENGINEERS

REV	DATE	DESCRIPTION	OWN BY	DES BY	CHK BY	APP BY
1	10/1/93	ISSUED FOR CONSTRUCTION	MC	J.B.	J.B.	J.B.
0	9/9/93	ISSUED FOR BLDG PERMIT	MC	J.B.	J.B.	J.B.
DATE OF ISSUE	9/9/93	OWN BY	MDC	DES BY	CHK BY	APP BY



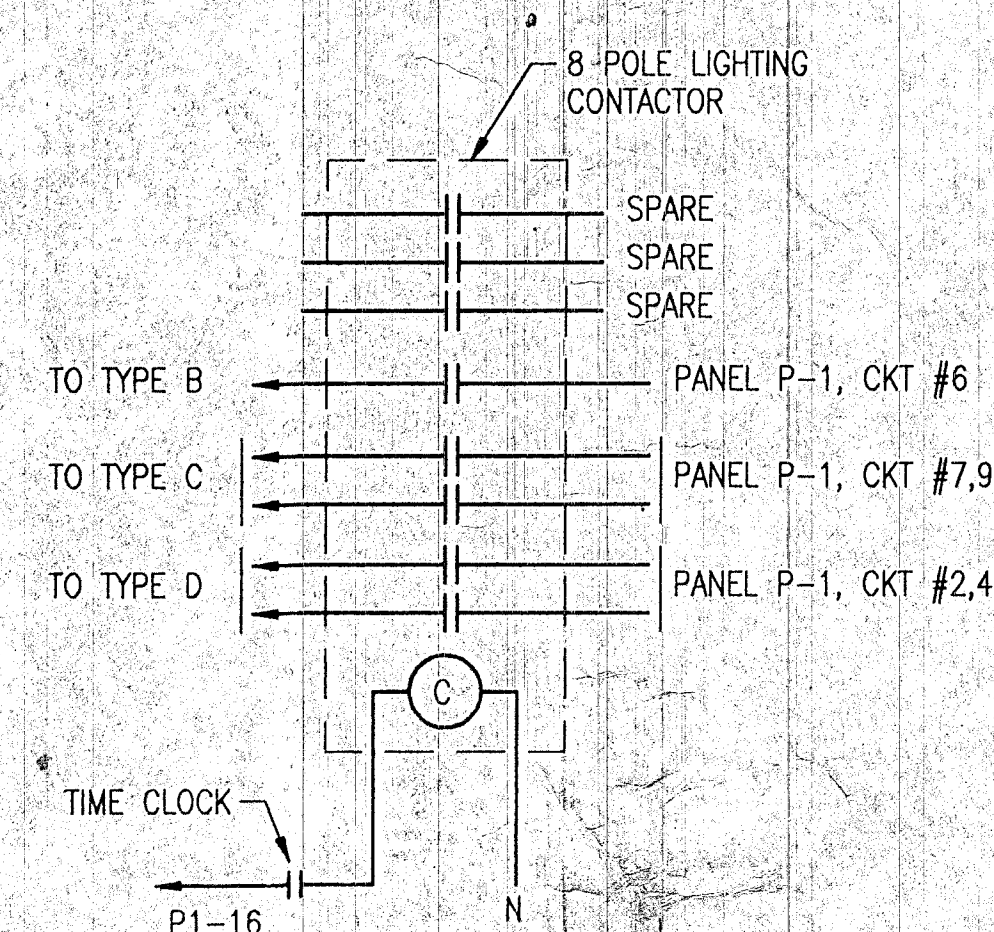
COLBURN TRANSFER STATION  
BONNER COUNTY, IDAHO  
**CONSTRUCTION PLANS  
BUILDING ELEVATIONS**

DRAWING NO  
**6**  
PROJECT NO  
0807-001.02

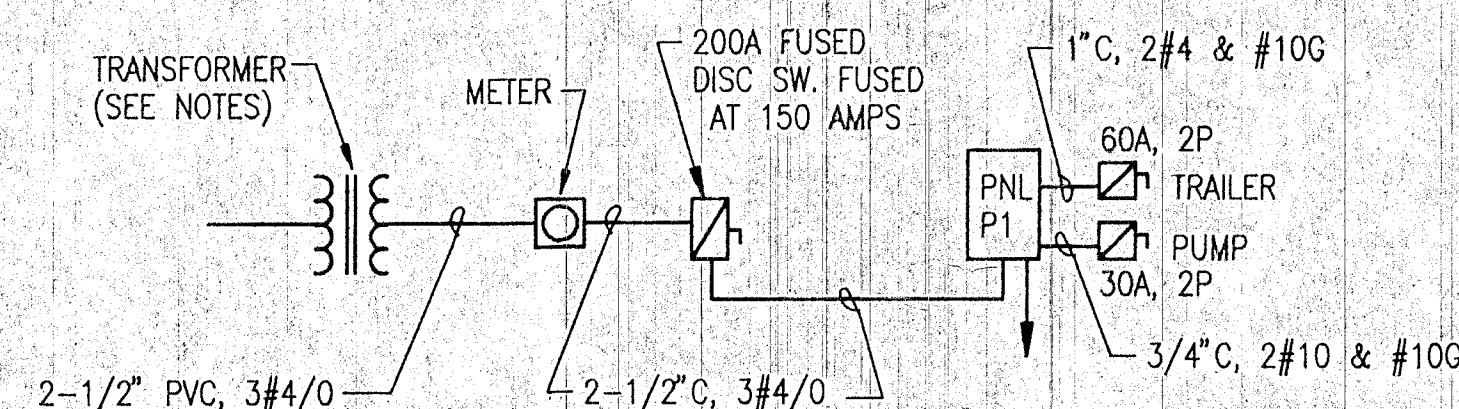


PANEL	P1	120/240	VOLTS	SINGLE PHASE	3	WIRE	225	AMPS	REMARKS:	SURFACE MOUNTING		
CIRCUIT DESCRIPTION	WIRE SIZE	KVA	LOAD	BKR	POLE	NO.	POLE	BKR	KVA	LOAD	WIRE	CIRCUIT DESCRIPTION
TRANSFER BLDG RECEPTACLES	#12	0.7		20	1		2	20	1.6		#12	FLOOD LIGHTS TYPE D
TRANSFER BLDG. LIGHTING TYPE A	#12	0.9		20	3		4	20	1.6		#12	WALL PACK TYPE B
TRANSFER BLDG. FLOOD LIGHTING TYPE C	#12	0.9		20	5		6	20	0.1		#12	DISC. SWITCH FOR PUMP
TRANSFER BLDG. TYPE A "IN PIT AREA"	#12	0.5		20	7		8	30	3.3		#10	DISC. SWITCH FOR TRAILER
SPARE	#12	0.9		20	9		10	60	2.8		#4	TIME CLOCK
SPARE	#12	0.9		20	11		12	20	2.8		#4	SPARE
SPARE	#12	0.9		20	13		14	20	2.8		#4	SPARE
SPARE	#12	0.9		20	15		16	20	2.8		#4	SPARE
SPARE	#12	0.9		20	17		18	20	2.8		#4	SPARE
SPARE	#12	0.9		20	19		20	20	2.8		#4	SPARE
SUBTOTAL		3.0	2.3						7.8	7.71		
TOTAL		10.8	10.01									

TOTAL CONNECTED LOAD = 20.81 KVA  
100% DEMAND LOAD = 20.81 KVA, 86.7 AMPS

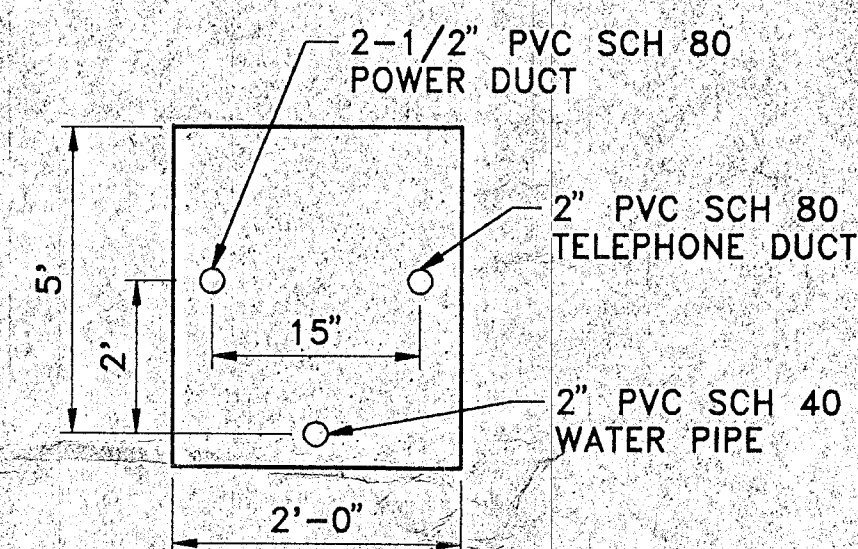


LIGHTING CONTROL SCHEMATIC  
SCALE: NONE

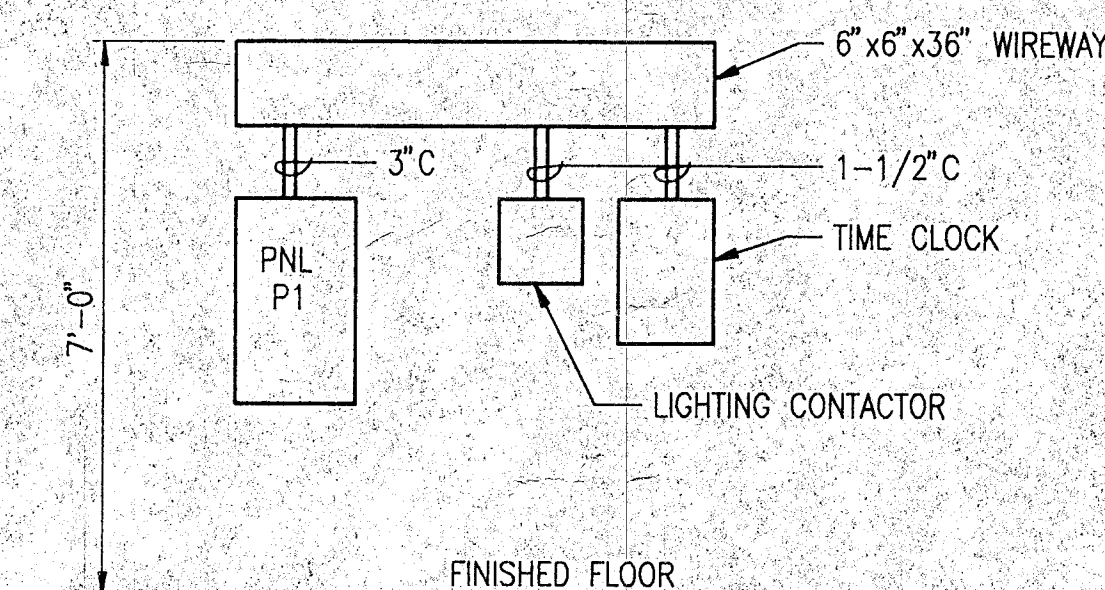


SINGLE LINE DIAGRAM  
SCALE: NONE

- NOTES
- NORTHERN LIGHT COMPANY (PHONE #208-263-5141) SHALL SUPPLY AND INSTALL THE TRANSFORMER & METER.
  - CONTRACTOR SHALL SUPPLY AND INSTALL A 200 AMP. MANUAL BY-PASS METER BASE AS REQUIRED BY NORTHERN LIGHT COMPANY.
  - SEE DRAWING #2 FOR PLAN OF POWER AND TELEPHONE DUCT SYSTEM.
  - COORDINATE WITH THE NORTHERN LIGHT COMPANY FOR THE DETAILS OF SERVICE DROP.
  - LIGHTING FIXTURES IN THE TRANSFER STATION SHALL BE SUPPORTED INDEPENDENTLY OF THE CONDUIT SYSTEM.
  - TELEPHONE AND POWER CONDUITS FROM TRANSFER STATION TO TRAILER OFFICE SHALL BE INSTALLED OVERHEAD ON THE WEST WALL OF TRANSFER STATION. FROM TRANSFER STATION SOUTH WALL TO TRAILER OFFICE THESE CONDUITS SHALL BE DIRECT BURIAL. POWER AND TELEPHONE CONDUIT SHALL BE 2-1/2" EMT INSIDE TRANSFER BLDG AND FOR DIRECT BURIAL IT SHALL BE 2-1/2" PVC SCH 80.



TRENCH DETAIL  
SCALE: NONE  
BACKFILL THE TRENCH WITH CLEAN DIRT & SAND



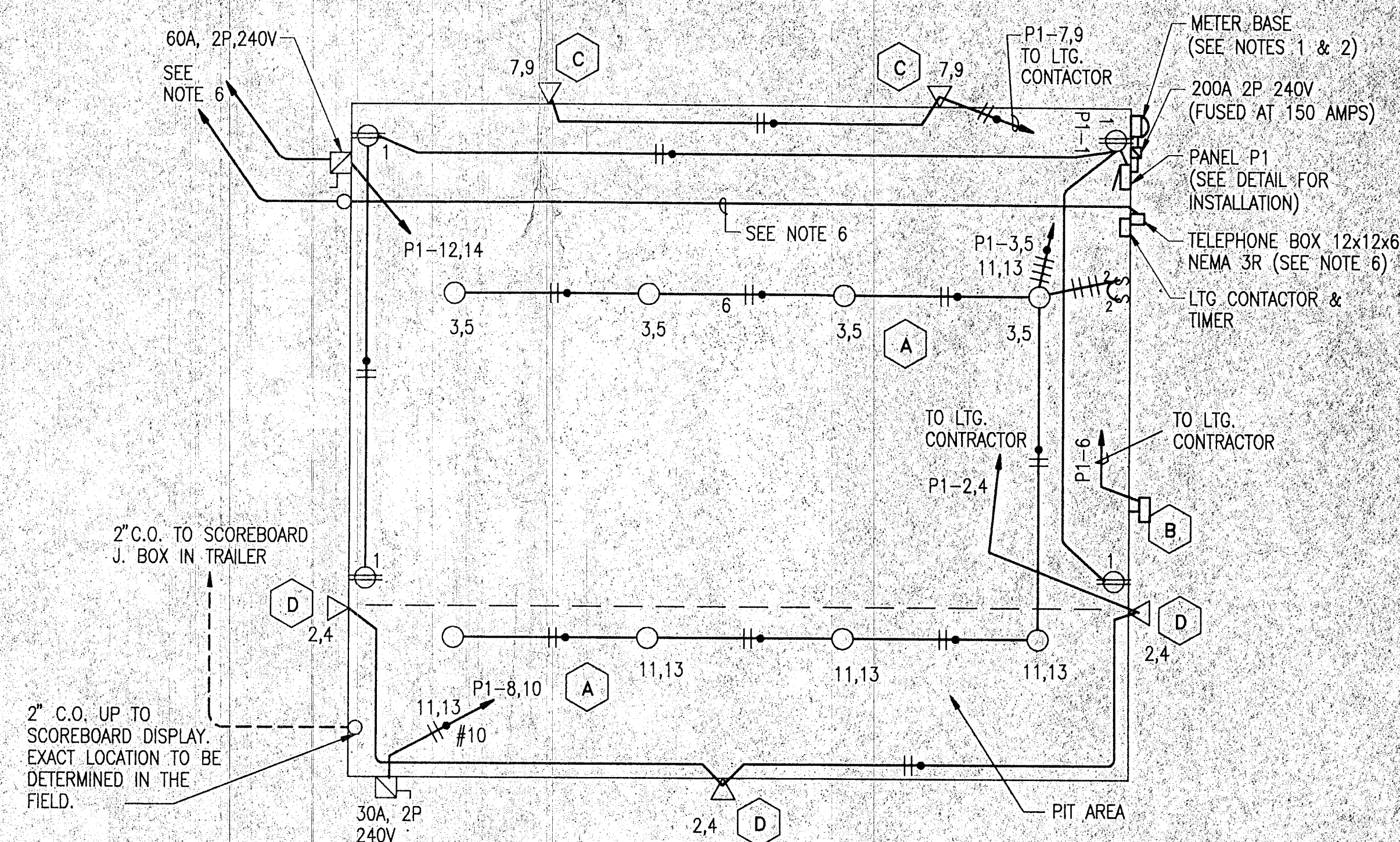
PANEL 'P1' INSTALLATION ON WALL  
SCALE: NONE

ALL THE EQUIPMENT SHOWN ABOVE SHALL BE SECURED PROPERLY ON THE WALL OF TRANSFER STATION USING UNISTRUT AND MATCHING HARDWARE

SYMBOL	DESCRIPTION	MANUFACTURER	REMARKS
A	INDUSTRIAL LOW-BAY 400 WATT METAL HALIDE	LITHONIA TX 400M A26-240-WL AND COLD WEATHER BALLAST TO -30°C	MOUNT UNDER PURLIN
B	INDUSTRIAL WALL PACK WITH 100 WATT METAL HALIDE LAMP	LITHONIA THW 100M 240 AND COLD WEATHER BALLAST TO -30°C	MOUNT ON BLDG WALL
C	400 WATT METAL HALIDE FLOODLIGHT	LITHONIA TFL-240 WITH COLD WEATHER BALLAST TO -30°C	MOUNT ON BLDG WALL
D	1000 WATT METAL HALIDE FLOODLIGHT	LITHONIA TF-240 WITH COLD WEATHER BALLAST TO -30°C	MOUNT ON BLDG WALL

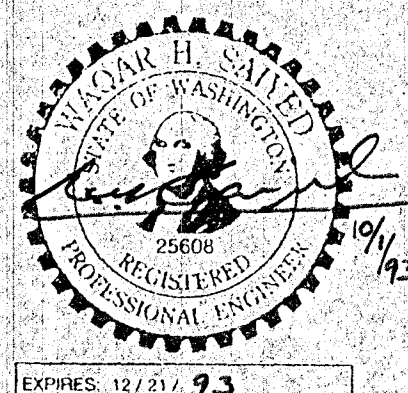
# LEGEND

- 3/4" CONDUIT WITH #12 NEUTRAL LINE & GROUND CONDUCTORS. ARROWHEAD INDICATES HOMERUN TO PANEL 'P1'
- DUPLX RECEPTACLE
- WALLPACK LIGHTING FIXTURE
- HIGH BAY LIGHTING FIXTURE
- TOGGLE SWITCH, 277V, DPST
- BURIED CONDUIT
- HANDHOLE-POWER/TELEPHONE UTILITY VAULT CO. 3030-LA
- 2P 240V DISCONNECT SWITCH NEMA 3R FUSED



TRANSFER BUILDING ELECTRICAL PLAN

SCALE: 1/8" = 1'-0"



Saiyed & Associates  
P.O. Box 12594  
Mill Creek, WA 98012-2594  
(206) 481-1649  
FAX (206) 481-8468

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