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Project Manual

KI Sawyer WWTF
Biosolids Handling Facility

Marquette County, Michigan

Prepared by:
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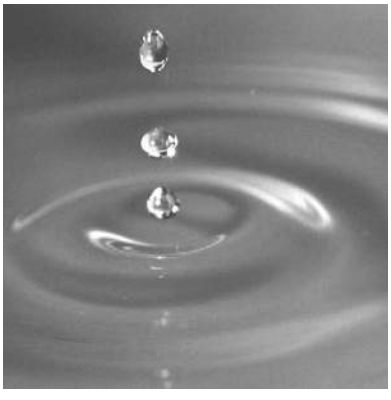
Project 2200905



PROJECT MANUAL

County of Marquette
KI SAWYER WWTF BIOSOLIDS HANDLING FACILITY
Marquette County, Michigan

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ADVERTISEMENT FOR BIDS
MARQUETTE COUNTY
KI SAWYER WASTEWATER TREATMENT PLANT
BIOSOLIDS HANDLING FACILITY

Marquette County (Owner) is requesting Bids for the construction of the following Project:

KI Sawyer Biosolids Handling Facility
2200905

Bids for the construction of the Project will be received at **Marquette County** located at **125 G Avenue, Gwinn, Michigan 49841**, until **February 28, 2023 at 2:00 p.m. local time**. At that time, the Bids received will be publicly opened and read.

The Project includes the following Work: Installation of a biosolids dewatering belt press and associated equipment including removal of existing RBC equipment, building demolition, construction of a pre-engineered steel building, site piping installation, electrical and controls, and general site restoration.

Bids are requested for the following Contract: **KI Sawyer Biosolids Handling Facility**

The Issuing Office for the Bidding Documents is:

GEI Consultants of Michigan, P.C.
990 Lalley Road, Iron River, MI 49935

Prospective Bidders may obtain paper copies of the Bidding Documents at the Issuing Office, upon payment of $250 (*non-refundable*) for each set by contacting Patty Ward at pward@geiconsultants.com. Cost does not include shipping charges. Upon Issuing Office's receipt of payment, printed Bidding Documents will be sent via the prospective Bidder's delivery service. The shipping charge amount will depend on the shipping method chosen.

Partial sets of Bidding Documents will not be available from the Issuing Office. Neither Owner nor Engineer will be responsible for full or partial sets of Bidding Documents, including addenda, if any, obtained from sources other than the Issuing Office.

Electronic PDF copies of the Contract documents can be provided via email at no cost by emailing your request to pward@geiconsultants.com.

Please contact Robb Anderson, P.E. at 906.214.4152 or raanderson@geiconsultants.com with questions regarding this project.

Builders Exchanges are authorized to share the contract documents with other exchanges. The Contract Documents may be examined at the following locations:

Marquette Builders Exchange
1229 West Washington Street
Marquette, MI 49855

Iron Mountain-Kingsford Builders Exchange
600 South Stephenson Avenue
Iron Mountain, MI 49801

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Delta County Builders Exchange
230 Ludington Street
Escanaba, MI 49829

Construction Association of Michigan
43636 Woodward Avenue
Bloomfield Hills, MI 48302

Lansing Builders Exchange
1240 E. Saginaw Street
Lansing, MI 48906

McGraw-Hill Dodge
dodge.docs@construction.com

Pre-bid Conference:

A mandatory pre-bid conference for the Project will be held on **February 14, 2023** at **1:00 p.m. local time** at **KI Sawyer Wastewater Treatment Plant, 1080 M-94, Gwinn, Michigan 49841**. Bids will not be accepted from Bidders that do not attend the mandatory pre-bid conference.

Instructions to Bidders:

For all further requirements regarding bid submittal, qualifications, procedures, and contract award, refer to the Instructions to Bidders that are included in the Bidding Documents.

This Advertisement is issued by:

Owner:	**Marquette County – KI Sawyer Wastewater Treatment Plant**
By:	**Duane DuRay**
Title:	**Director of Operations**
Date:	**January 26, 2023**

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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 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.

2.04 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 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.

2.05 *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.

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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 2.05.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. **AutoDesk Civil 3D Design Files**

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 **five (5)** 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.

E. Other required information regarding qualifications.

F. The number of years engaged in the contracting business under the present firm name, and the name of the state where incorporated.

G. A list of the property and equipment available to the Bidder to evaluate if the Bidder can complete the Work in accordance with the Bidding Documents.

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H. A financial statement of the Bidder showing the Bidder has the financial resources to meet all obligations incidental to the Work.

I. The Bidder's performance record giving the description, location, and telephone numbers of similar projects constructed in a satisfactory manner by the Bidder.

J. A list of projects presently under contract, the approximate contract amount, and percent completion of each.

K. A list of contracts which resulted in lawsuits.

L. A list of contracts defaulted.

M. A statement of the Bidder indicating whether the Bidder has ever filed bankruptcy while performing Work of like nature or magnitude.

N. A list of officers of the firm who, while in the employ of previous firms, were associated with contracts which resulted in lawsuits, contracts defaulted or filed for bankruptcy.

O. The technical experience of personnel guaranteed to be employed in the responsible charge of the Work stating whether the personnel have or have not performed satisfactorily on other contracts of like nature and magnitude or comparable difficulty at similar rate of progress.

P. Such additional information as will assist Owner in determining whether the Bidder is adequately prepared to fulfill the contract.

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.

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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 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.

4.02 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 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.

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d. Technical Data contained in such reports and drawings.

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

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

B. *Underground Facilities:* 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. **None.**

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~~ **during** 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.

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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: **Robb Anderson, P.E., Iron River, MI 49935, 906.214.4152**. 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 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 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.

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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:

Robb A. Anderson, P.E., Project Manager

GEI Consultants of Michigan, P.C.

990 Lalley Road, Iron River, MI 49935

raanderson@geiconsultants.com

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 **five (5)** 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 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 5% 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

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Contract or ~~61~~ ***91*** 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.~~

Deleted

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.~~

Deleted

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. 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

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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.

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 within five days after Bid opening:

A. **All Subcontractors**

B. **All Suppliers**

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.

ARTICLE 12—PREPARATION OF BID

12.01 The Bid Form is included with the Bidding Documents.

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.

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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, if any, must also be shown on the Bid Form.

12.13 ***On unit price work, the Bid price shall be the total of unit prices extended by the estimated number of units set forth in the Bid, and include a separate price for each alternate described in the Specifications as provided in the Bid Form. The price of the Bid for each alternate will be the amount to be added or deducted from the price of the Total Base Bid if Owner selects the alternate.***

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12.14 ***Bidder is required to fill in unit or supplemental prices for each item as called for in the Bid Form, if any.***

12.15 ***It is the responsibility of the Bidder to submit a neat, accurate, and complete Bid.***

ARTICLE 13—BASIS OF BID

13.01 *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 the Bid Form.

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

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

13.02 *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.

ARTICLE 14—SUBMITTAL OF BID

14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.

14.02 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 and 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.

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

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

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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.~~ ***not be modified prior to the Bid opening time if a Bidder claims a mistake, omission, or error in the preparation of the Bid. Bids may be withdrawn prior to the opening of Bids upon written request of the Bidder, or the personal appearance of the Bidder or Bidder's designated representative.***

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.

ARTICLE 16—OPENING OF BIDS

16.01 Bids will be opened at the time and place indicated in the advertisement or 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.

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 ***Total Base*** 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.

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

C. The project is to be awarded based on the Total Base Bid.

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.

18.08 ***If the Contract is to be awarded, Owner will award the Contract to the responsible Bidder whose Total Base Bid, conforming with all the material terms and conditions of the Instructions to Bidders, is lowest, price and other factors considered.***

18.09 ***Owner shall have the right to reject any unit prices for additions to or deductions from the work as given in the Bid, if the prices stated are considered excessive or unreasonable, or to accept any unit prices which may be considered fair and reasonable.***

18.10 ***Owner shall have the right to accept alternates in any order or combination or to not accept any, unless specifically otherwise provided.***

18.11 ***A Bid which does not contain a unit price which is both adequate and reasonable for each item named in the Bid may be considered irregular and the Bid subject to rejection.***

18.12 ***If the Contract is to be awarded, it will be awarded to the lowest, responsible Bidder.***

18.13 ***If the Contract is to be awarded, Owner will give successful Bidder notification within a reasonable time.***

18.14 ***Owner is prohibited from knowingly soliciting Bids from, negotiating with, or awarding Contracts to, and approving or allowing subcontractors with a debarred Contractor.***

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

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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.~~

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

~~**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—WORK WITHIN THE HIGHWAY AND PUBLIC RIGHT-OF-WAY REQUIREMENTS

24.01 ***All piping, valves, fittings, and associated appurtenances shall be stockpiled such that they do not interfere with the safe and free movement of traffic. If equipment uses or obstructs any portion of public roadways during the performance of the work, proper traffic control (including flag persons) shall be required.***

24.02 ***At no time shall excavated material(s) or imported material(s) be stockpiled on paved roadway surfaces. If the paved roadway surface is damaged by the Contractor as a result of stockpiling excavated material(s) or imported material(s) on paved roadway surfaces, the Contractor shall be required to repair the paved roadway surface at no additional cost to the Owner.***

24.03 ***At no time shall track equipment be permitted to travel on or across paved roadway surfaces without providing adequate protection between the tracks and paved roadway surface. If the paved roadway surface is damaged by failure to provide adequate protection between the tracks and paved roadway surface, the Contractor shall be required to repair the paved roadway surface at no additional cost to the Owner.***

24.04 ***The Contractor shall provide adequate support and bracing during excavation, dewatering, and backfilling operations to protect the structural integrity of all curbing, shoulders, sewers, paved areas, and utilities located within the 1-on-1 slope from the shoulder point or back of curb to the bottom of any excavation.***

24.05 ***Safety requirements shall be conformed to and all operations shall be conducted so as to not damage, destroy, or endanger the integrity of the roadway pavement structure. All work within the public right-of-way shall be conducted in accordance with MIOSHA safety rules and regulations.***

24.06 ***The Contractor shall provide temporary access to private drives and public alleys during evenings, weekends, holidays, and during any other time when no construction activity is occurring in the immediate area.***

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24.07 ***The Contractor shall not be permitted to perform site clearing and grubbing outside of the limits indicated on the Drawings.***

ARTICLE 25—SOIL EROSION AND SEDIMENTATION CONTROL MEASURES

25.01 ***The Contractor shall be responsible for obtaining and paying for the necessary permit to comply with the Soil Erosion and Sedimentation Control Act 347 P.A. 1972 if the Contract is awarded. The Contractor shall be responsible for all costs related to obtaining and maintaining the conditions laid out in the permit.***

25.02 ***The Contractor shall submit a copy of the approved permit to Owner and Engineer prior to issuance of the Notice to Proceed. If the project exceeds 5 acres of disturbance, Owner will obtain the required "Notice of Coverage" (NOC) for National Pollutant Discharge Elimination System (NPDES) Storm Water Discharges from Construction Activities from the State of Michigan. The Contractor will be responsible for meeting all rules and requirements of the NOC.***

ARTICLE 26—Prevailing Wages

26.01 ***The advertised specifications for every contract in excess of $50,000 to which the County of Marquette is a party, for construction, alteration, and/or repair, including painting and decorating of public buildings or public works in or for the County of Marquette, and which requires or involves the employment of mechanics and/or laborers, shall contain a provision stating the minimum wages to be paid the various classes of laborers and mechanics that shall be based upon the wages determined by the Secretary of Labor to be prevailing for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in or in the vicinity of the County of Marquette. Projects funded in whole or part by the Federal and State government may have other criteria for the requirement of prevailing wages. If more restrictive than County Policy, those procedures will be followed. Every contract based upon specifications referred to in (a) above shall contain a stipulation that:***

A. Contractor or his subcontractor shall pay all mechanics and laborers employed directly upon the site of the work, unconditionally and not less often than once every two weeks, and without subsequent deduction or rebate on any account, the full amount accrued at the time of payment, computed at wage rates not less than those stated in the advertised specifications, regardless of any contractual relationship which may be alleged to exist between the contractor or subcontractor and such laborers and mechanics;

B. The scale of wages to be paid shall be posted by the contractor in a prominent and easily accessible place at the site of the work.

C. There may be withheld from the contractor so much of accrued payments as may be considered necessary by the County Administrator to pay laborers and mechanics employed by the contractor or any subcontractor on the work for the difference between the rates of wages required by the contract and the rates of wages received by such laborers and mechanics except those amounts deducted or refunded pursuant to the terms of P.A. 166 of 1965 (MCL 408.551 to 408.558) and interpretations thereof.

D. The overtime pay to which a laborer or mechanic working on the contract is entitled shall be that overtime pay to which he is entitled by any agreement he may have made with the contractor or subcontractor or by any applicable provision of law, but in no event shall such amount be less than the prevailing wage in Marquette County for such overtime.

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26.02 ***The wage rate determination can be found at https://sam.gov/content/wage-determinations. The current wage rates are located in Appendix B. The Contractor will be responsible for obtaining the current wage determination.***

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BID FORM FOR CONSTRUCTION CONTRACT

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

ARTICLE 1—OWNER AND BIDDER

This Bid is submitted to: **Marquette County Airport Services Center, 125 G Avenue, Gwinn, MI 49841**

1.01 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. 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;

E. Contractor's license number 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;

F. ~~Required Bidder Qualification Statement with supporting data; and~~

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

3.01 *Lump Sum Bids*

A. Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s), together with any Unit Prices indicated in Paragraph 3.02:

1. Lump Sum Price (Single Lump Sum)

Lump Sum Bid Price	$

a. Contractor shall complete the attached Base Bid Schedule showing how they arrived at the Lump Sum amount.

2. Lump Sum Price (Base Bid and Alternates)

Lump Sum Bid Price for Base Bid	$
Alternate Add 'A'	$

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a. Contractor shall complete the attached Alternate Add Bid Schedule showing how they arrived at the Lump Sum amount.

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.

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~~ ***91*** 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 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:

Addendum Number	Addendum Date	***Signature***

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.
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**.**
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

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Supplementary Conditions, 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, 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 8.02.A:

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.

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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.

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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) _____

Bidder's Dun and Bradstreet (DUNS) No.: _____

Bidder's Tax Identification No.: _____

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MARQUETTE COUNTY
KI SAWYER WASTEWATER TREATMENT FACILITY
KI SAWYER BIOSOLIDS HANDLING FACILITY
BASE BID SCHEDULE
GEI PROJECT #2200905

Item No.	Item Description	Estimated Quantity	Unit	Bid Value
M-0110	Mobilization	1	LSUM	$
M-0210	Contractor Staking	1	LSUM	$
M-0510	Soil Erosion and Sedimentation Control	1	LSUM	$
SITE CIVIL				
C-001	Pavement and Concrete Sidewalk Removal	1	LSUM	$
C-002	Site Preparation and Rough Grading	1	LSUM	$
C-003	Site Piping and Utilities	1	LSUM	$
C-008	Electrical Conduit	1	LSUM	$
C-009	Site Paving	1	LSUM	$
C-010	Final Grading and Restoration	1	LSUM	$
RBC BUILDING				
RB-001	Remove Existing Building Roof and Entry Way	1	LSUM	$
RB-002	Storage Area Wall Removal and Furnishing and Installing Jambs	1	LSUM	$
RB-003	Remove Existing Building Concrete Walkways and Structural Removal	1	LSUM	$
RB-004	Remove Existing RBC Equipment	1	LSUM	$
RB-005	Electrical Removal	1	LSUM	$
RB-006	Other Mechanical and HVAC Removal	1	LSUM	$
RB-007	Other General Removal Costs	1	LSUM	$
SLUDGE PUMPING BUILDING				
SB-001	Removal of Pumps, Piping, Fittings, and Valves	1	LSUM	$
SB-002	Install Sludge Pump and Concrete Base	1	LSUM	$
SB-003	Furnish and Install of Piping, Fittings, and Valves	1	LSUM	$
SB-004	Electrical and Controls	1	LSUM	$

MARQUETTE COUNTY
KI SAWYER WASTEWATER TREATMENT FACILITY
KI SAWYER BIOSOLIDS HANDLING FACILITY
BASE BID SCHEDULE
GEI PROJECT #2200905

BIOSOLIDS DEWATERING AND STORAGE				
B-001	Engineered Fill and Concrete Slabs	1	LSUM	$
B-002	Press Room Foundation, Concrete Slab, Concrete Pedestals, and Containment Curb	1	LSUM	$
B-003	Furnish and Construct Pre-Engineered Building	1	LSUM	$
B-004	Installation of Belt Press	1	LSUM	$
B-005	Press Room Structural Steel	1	LSUM	$
B-006	Press Room Mechanical	1	LSUM	$
B-007	Press Room HVAC	1	LSUM	$
B-008	Press Room Electrical, Lighting, and Controls	1	LSUM	$

TOTAL ==> $ _____

MARQUETTE COUNTY
KI SAWYER WASTEWATER TREATMENT FACILITY
KI SAWYER BIOSOLIDS HANDLING FACILITY
ALTERNATE ADD 'A' BID SCHEDULE - REMOVE RBC BASINS
GEI PROJECT #2200905

Item No.	Item Description	Estimated Quantity	Unit	Bid Value
REMOVE RBC BASINS				
ADD-001A	Remove RBC Covers and Equipment	1	LSUM	$
ADD-002A	Concrete Removal and Backfill	1	LSUM	$
ADD-003A	Piping Removal	1	LSUM	$
ADD-004A	Electrical Removal	1	LSUM	$
ADD-005A	Site Restoration	1	LSUM	$

ALTERNATE ADD 'A' TOTAL ==> $ _____

BID BOND (PENAL SUM FORM)

Bidder	**Surety**
Name:	Name:
Address *(principal place of business)*:	Address *(principal place of business)*:
Owner	**Bid**
Name: **Marquette County**	Project *(name and location)*:
Address *(principal place of business)*:	**KI Sawyer Biosolids Handling Facility**
1080 M-94	**Gwinn, Michigan**
Gwinn, MI 49841	
	Bid Due Date: **[Enter date bid is due]**
Bond	
Penal Sum:	
Date of Bond:	

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
_____	_____
(Full formal name of Bidder)	*(Full formal name of Surety) (corporate seal)*
By: _____	By: _____
(Signature)	*(Signature) (Attach Power of Attorney)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title: _____	Title: _____
Attest: _____	Attest: _____
(Signature)	*(Signature)*
Name: _____	Name: _____
(Printed or typed)	*(Printed or typed)*
Title:	Title:

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.

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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.

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NOTICE OF AWARD

Date of Issuance:			
Owner:	**Marquette County**	Owner's Project No.:	
Engineer:	**GEI Consultants of Michigan, P.C.**	Engineer's Project No.:	**2200905**
Project:	**KI Sawyer Biosolids Handling Facility**		
Contract Name:	**KI Sawyer Biosolids Handling Facility**		
Bidder:			
Bidder's Address:			

You are notified that Owner has accepted your Bid dated **[date]** for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

[Describe Work, alternates, or sections of Work awarded]

The Contract Price of the awarded Contract is $**[Contract Price]**. 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.

Four (4) 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 **four (4)** 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): **[Describe other conditions that require Successful Bidder's compliance]**

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: **Marquette County, Michigan**

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Copy: Engineer

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

This Agreement is by and between **Marquette County** ("Owner") and **[name of contracting entity]** ("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: **Installation of a biosolids dewatering belt press and associated equipment including removal of existing RBC equipment, building demolition, construction of a pre-engineered steel building, site piping installation, electrical and controls, and general site restoration.**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: **KI Sawyer Biosolids Handling Facility**

ARTICLE 3—ENGINEER

3.01 The Owner has retained **GEI Consultants of Michigan, P.C.** ("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.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

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

4.02 *Contract Times: Dates*

A. The Work will be substantially complete on or before **December 5, 2023**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **January 5, 2024**.

~~4.03 *Contract Times: Days*~~

~~A. The Work will be substantially complete within **[number]** 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 **[number]** days after the date when the Contract Times commence to run.~~

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~~4.04 *Milestones*~~

~~A. Parts of the Work must be substantially completed on or before the following Milestone(s):~~

~~1. Milestone 1 **[event & date/days]**~~

~~2. Milestone 2 **[event & date/days]**~~

~~3. Milestone 3 **[event & date/days]**~~

4.05 *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 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 $**1,000.00** 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 $**1,000.00** for each day that expires after such time until the Work is completed and ready for final payment.

3. *Milestones:* Contractor shall pay Owner $**1,000.00** 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.

4.06 *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.

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

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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:

A. 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 **30th** 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. **~~[number]~~95** percent of the value of the Work completed (with the balance being retainage).

1) ~~If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work remain satisfactory to Owner and Engineer, there will be no additional retainage; and~~

Deleted

b. **~~[number]~~95** percent 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

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payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200** percent 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 **[number]** percent per annum.~~

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. Drawings (not attached but incorporated by reference) consisting of **47** sheets with each sheet bearing the following general title: **KI Sawyer Biosolids Handling Facility**.
7. Drawings listed on the attached sheet index.
8. Addenda (numbers **[number]** to **[number]**, inclusive).
9. Exhibits to this Agreement (enumerated as follows):
    a. **[list exhibits]**
10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.

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d. Field Orders.

e. ~~Warranty Bond, if any.~~

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.

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.

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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.

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

This Agreement will be effective on **[indicate date on which Contract becomes effective]** (which is the Effective Date of the Contract).

Owner:

Marquette County
(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: _____

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PERFORMANCE BOND

Contractor Name: **[Full formal name of Contractor]** Address *(principal place of business)*: **[Address of Contractor's principal place of business]**	**Surety** Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner Name: **Marquette County** Mailing address *(principal place of business)*: **1080 M-94** **Gwinn, MI 49841**	**Contract** Description *(name and location)*: **KI Sawyer Biosolids Handling Facility** **Gwinn, Michigan** Contract Price: **[Amount from Contract]** Effective Date of Contract: **[Date from Contract]**

Bond

Bond Amount: **[Amount]**

Date of Bond: **[Date]**

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ 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
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

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

EJCDC® C-610, Performance Bond.
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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:

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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

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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: **[Describe modification or enter "None"]**

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PAYMENT BOND

Contractor	**Surety**
Name: **[Full formal name of Contractor]** Address *(principal place of business)*: **[Address of Contractor's principal place of business]**	Name: **[Full formal name of Surety]** Address *(principal place of business)*: **[Address of Surety's principal place of business]**
Owner	**Contract**
Name: **Marquette County** Mailing address *(principal place of business)*: **1080 M-94** **Gwinn, MI 49841**	Description *(name and location)*: **KI Sawyer Biosolids Handling Facility** **Gwinn, Michigan** Contract Price: **[Amount, from Contract]** Effective Date of Contract: **[Date, from Contract]**

Bond

Bond Amount: **[Amount]**

Date of Bond: **[Date]**

(Date of Bond cannot be earlier than Effective Date of Contract)

Modifications to this Bond form:

☐ None ☐ 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
_____ *(Full formal name of Contractor)*	_____ *(Full formal name of Surety) (corporate seal)*
By: _____ *(Signature)*	By: _____ *(Signature)(Attach Power of Attorney)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____
Attest: _____ *(Signature)*	Attest: _____ *(Signature)*
Name: _____ *(Printed or typed)*	Name: _____ *(Printed or typed)*
Title: _____	Title: _____

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

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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.

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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;

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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: **[Describe modification or enter "None"]**

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CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	**Marquette County**	Owner's Project No.:	
Engineer:	**GEI Consultants of Michigan, P.C.**	Engineer's Project No.:	**2200905**
Contractor:		Contractor's Project No.:	
Project:	**KI Sawyer Biosolids Handling Facility**		
Contract Name:	**KI Sawyer Biosolids Handling Facility**		

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

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

[Describe the portion of the work for which Certificate of Substantial Completion is issued]

Date of Substantial Completion: **[Enter date, as determined by Engineer]**

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:

[List amendments to Owner's Responsibilities]

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

[List amendments to Contractor's Responsibilities]

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

[List attachments such as punch list; other documents]

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

Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

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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

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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

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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.

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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.

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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.

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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.

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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

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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.

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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

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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.

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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

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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.

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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.

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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

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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.

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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

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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;

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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

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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

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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

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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

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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

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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.

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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);

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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

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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.

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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.

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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;

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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

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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.

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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

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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.

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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:

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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.

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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

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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

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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

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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

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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.

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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, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. 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

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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

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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.

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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,

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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,

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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

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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.

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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;

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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

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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

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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.

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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,

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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.

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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,

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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

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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.

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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.

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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**

~~No suggested Supplementary Conditions in this Article.~~

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).

Article 2—**PRELIMINARY MATTERS**

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:

B. *Evidence of Contractor’s Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner 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.

2.02 *Copies of Documents*

SC-2.02 Delete Paragraph 2.02.A in its entirety and insert the following new paragraph in its place:

A. Owner shall furnish to Contractor **five (5)** printed copies of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and

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one copy in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

2.06 *Electronic Transmittals*

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. 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

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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 **25** 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.

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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.

~~h. The Owner will operate a Project information management system (also referred to in this EDP as "Project Website") for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information. The following conditions and standards will govern use of the Project Website:~~

~~1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;~~

~~2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;~~

~~3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and~~

~~4) Include any other Project Website attributes that may be pertinent to Contractor's use of the facility and pricing of such use.~~

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.

   a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this 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.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

No suggested Supplementary Conditions in this Article.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.05 *Delays in Contractor's Progress*

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 listed in SC 4.05.C.5.b.**

b. Should the Contractor wish to claim a delay due to adverse weather, it is the Contractor's responsibility to provide adequate documentation for the claim.

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

5.03 *Subsurface and Physical Conditions*

SC-5.03 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
Soil Borings	June 30 & July 1 2020	Soil Borings

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~~

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~~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~~
~~N/A~~		~~[Identify Technical Data]~~

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 **[location]** during regular business hours, or~~ may request copies from Engineer.

5.06 *Hazardous Environmental Conditions*

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
None	None	None

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: **[If there are no such drawings, so indicate in the table]**

Drawings Title	Date of Drawings	Technical Data
None		

Article 6—**BONDS AND INSURANCE**

6.01 *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 (~~2010, 2013, or~~ 2018 edition).

2. *Required Payment Bond Form:* The payment bond that Contractor furnishes will be in the form of EJCDC® C-615, Payment Bond (~~2010, 2013, or~~ 2018 edition).

6.02 *Insurance—General Provisions*

SC-6.02 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

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accepted to provide worker's compensation insurance for similar projects by the state within the last 12 months.

6.03 *Contractor's Insurance*

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: **Marquette County, Michigan and GEI Consultants of Michigan, P.C.**

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).

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Jones Act (if applicable)	
Bodily injury by accident—each accident	**$ 1,000,000**
Bodily injury by disease—aggregate	**$ 1,000,000**
Employer's Liability	
Each accident	**$ 1,000,000**
Each employee	**$ 1,000,000**
Policy limit	**$ 2,000,000**
Stop-gap Liability Coverage	
~~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:~~	~~$~~

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

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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.

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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*

Commercial General Liability	Policy limits of not less than:
General Aggregate	**$ 5,000,000**
Products—Completed Operations Aggregate	**$ 2,000,000**
Personal and Advertising Injury	**$ 1,000,000**
Bodily Injury and Property Damage—Each Occurrence	**$ 1,000,000**

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.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	**$ 1,000,000**
Each Accident	**$ 1,000,000**
Property Damage	
Each Accident	**$ 1,000,000**
~~**[or]**~~	
~~**Combined Single Limit**~~	
~~Combined Single Limit (Bodily Injury and Property Damage)~~	~~$~~

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.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	**$ 5,000,000**
General Aggregate	**$ 5,000,000**

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

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excess policy must retain a minimum limit of $**5,000,000** 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.

Contractor's Pollution Liability	**Policy limits of not less than:**
Each Occurrence/Claim	$ 1,000,000
General Aggregate	$ 2,000,000

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.

Contractor's Professional Liability	**Policy limits of not less than:**
Each Claim	**$ 1,000,000**
Annual Aggregate	**$ 2,000,000**

~~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.~~

~~[Insert additional specific requirements, commonly set by the railroad, here.]~~

~~Railroad Protective Liability Insurance~~	**~~Policy limits of not less than:~~**
~~Each Claim~~	
~~Aggregate~~	~~$~~

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

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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.

Unmanned Aerial Vehicle Liability Insurance	Policy limits of not less than:
Each Claim	**$ 1,000,000**
General Aggregate	**$ 2,000,000**

Q. *Other Required Insurance:* **None**

6.04 *Builder's Risk and Other Property 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).

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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).

5. extend to cover damage or loss to insured property while in transit.

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**

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*~~

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~~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.~~

Article 7—**CONTRACTOR'S RESPONSIBILITIES**

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be **7:00 a.m to 7:00 p.m., including Saturday.**
2. Owner's legal holidays are **Standard US Federal Holidays**.

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 **Saturday**. Contractor will not perform Work on a **Sunday**, or any legal holiday."

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.

Article 8—**OTHER WORK AT THE SITE**

No suggested Supplementary Conditions in this Article.

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

Article 9—**OWNER'S RESPONSIBILITIES**

No suggested Supplementary Conditions in this Article.

Article 10—**ENGINEER'S STATUS DURING CONSTRUCTION**

10.03 *Resident Project Representative*

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. *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.

2. *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.

3. *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.

4. *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.

5. *Inspections and Tests*

   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.

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b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.

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

7. *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**

No suggested Supplementary Conditions in this Article.

Article 12—**CLAIMS**

No suggested Supplementary Conditions in this Article.

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

13.01 *Cost of the Work*

SC-13.01 Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work

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provisions of this Contract is the most current edition of **Michigan Department of Transportation Rental Rates.**

SC-13.01 Supplement Paragraph 13.01.C.2 by adding 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.

13.03 *Unit Price Work*

SC-13.03 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 five [5] percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than 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 ACCCEPTANCE OF DEFECTIVE WORK**

No suggested Supplementary Conditions in this Article.

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

15.01 *Progress Payments*

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

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.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.B.6 – Add new paragraph immediately after Paragraph 15.01.B.5:

6. 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.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 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.~~

15.03 *Substantial Completion*

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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.

~~15.08 *Correction Period*~~

~~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**

No suggested Supplementary Conditions in this Article.

Article 17—**FINAL RESOLUTIONS OF DISPUTES**

17.02 *Arbitration*

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

17.02 *Arbitration*

A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of $100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.

B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.

C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages,

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except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.

D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.

E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.

F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.

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

1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;

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

3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and

4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.

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

I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.

17.03 *Attorneys' Fees*

SC-17.03 Add the following new paragraph immediately after Paragraph 17.02.

17.03 *Attorneys' Fees*

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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**

~~18.08 *Assignment of Contract*~~

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

~~B. The contract dated **[date]** between Owner as "buyer" and **[identify seller]** as "seller" for procurement of goods and special services ("procurement contract") **[is hereby] [will be]** assigned to Contractor by Owner, and Contractor **[accepts] [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]**.~~

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	
a.2	Meeting agendas, meeting minutes, RFI's and responses to RFI's, and Contract forms.	Email w/ Attachment	PDF	(2)
a.3	Contactors 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	

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

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 **10** or later
DWG	Autodesk® AutoCAD .dwg format Version **2020**
DOC	Microsoft® Word .docx format Version **2016**
EXC	Microsoft® Excel .xls or .xml format Version **2016**
DB	Microsoft® Access .mdb format Version **2016**

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NOTICE TO PROCEED

Owner:	**Marquette County**	Owner's Project No.:	
Engineer:	**GEI Consultants of Michigan, P.C.**	Engineer's Project No.:	**2200905**
Contractor:		Contractor's Project No.:	
Project:	**KI Sawyer Biosolids Handling Facility**		
Contract Name:	**KI Sawyer Biosolids Handling Facility**		
Effective Date of Contract:			

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **[date Contract Times are to start]** 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: **[Select one of the following two alternatives, insert dates or number of days, and delete the other alternative.]**

The date by which Substantial Completion must be achieved is **November 1, 2022**, and the date by which readiness for final payment must be achieved is **November 15, 2022**.

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

[Note any access limitations, security procedures, or other restrictions]

Owner:	**Marquette County**
By *(signature)*:	
Name *(printed)*:	
Title:	
Date Issued:	

Copy: Engineer

EJCDC® C-550, Notice to Proceed.
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Contractor's Application for Payment

Owner:	**Marquette County**	**Owner's Project No.:**	
Engineer:	**GEI Consultants of Michigan, P.C.**	**Engineer's Project No.:**	**2200905**
Contractor:		**Contractor's Project No.:**	
Project:	**KI Sawyer Biosolids Handling Facility**		
Contract:	**KI Sawyer Biosolids Handling Facility**		
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

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. Amount due this application					$ -
9. Balance to finish, including retainage (Line 3 - Line 4 + Line 5.c)					$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor:

Signature: **Date:**

Recommended by Engineer		**Approved by Owner**	
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	
Approved by Funding Agency			
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	Marquette County	**Owner's Project No.:**	
Engineer:	GEI Consultants of Michigan, P.C.	**Engineer's Project No.:**	2200905
Contractor:		**Contractor's Project No.:**	
Project:	KI Sawyer Biosolids Handling Facility		
Contract:	KI Sawyer Biosolids Handling Facility		

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

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

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Progress Estimate - Lump Sum Work

Contractor's Application for Payment

Owner:	Marquette County	**Owner's Project No.:**	
Engineer:	GEI Consultants of Michigan, P.C.	**Engineer's Project No.:**	2200905
Contractor:		**Contractor's Project No.:**	
Project:	KI Sawyer Biosolids Handling Facility		
Contract:	KI Sawyer Biosolids Handling Facility		

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

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

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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: Marquette County
Engineer: GEI Consultants of Michigan, P.C.
Contractor:
Project: KI Sawyer Biosolids Handling Facility
Contract: KI Sawyer Biosolids Handling Facility

Owner's Project No.:
Engineer's Project No.: 2200905
Contractor's Project No.:

Application No.: **Application Period:** **From** **to** **Application Date:**

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	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) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Original Contract											
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
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					-		-		-		-
				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: Marquette County
Engineer: GEI Consultants of Michigan, P.C.
Contractor:
Project: KI Sawyer Biosolids Handling Facility
Contract: KI Sawyer Biosolids Handling Facility

Owner's Project No.:
Engineer's Project No.: 2200905
Contractor's Project No.:

Application No.: **Application Period:** From to **Application Date:**

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	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) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
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					-		-		-		-
					-		-		-		-
					-		-		-		-
					-		-		-		-
				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment
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Stored Materials Summary

Contractor's Application for Payment

Owner:	Marquette County	**Owner's Project No.:**	
Engineer:	GEI Consultants of Michigan, P.C.	**Engineer's Project No.:**	2200905
Contractor:		**Contractor's Project No.:**	
Project:	KI Sawyer Biosolids Handling Facility		
Contract:	KI Sawyer Biosolids Handling Facility		

Application No.: _____ **Application Period:** **From** _____ **to** _____ **Application Date:** _____

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
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								-			-	-
								-			-	-
								-			-	-
								-			-	-
								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

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CHANGE ORDER NO.: [Number of Change Order]

Owner:	**Marquette County**	Owner's Project No.:	
Engineer:	**GEI Consultants of Michigan, P.C.**	Engineer's Project No.:	**2200905**
Contractor:		Contractor's Project No.:	
Project:	**KI Sawyer Biosolids Handling Facility**		
Contract Name:	**KI Sawyer Biosolids Handling Facility**		
Date Issued:		Effective Date of Change Order:	

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

Description:

[Description of the change]

Attachments:

[List documents related to the change]

Change in Contract Price	**Change in Contract Times [State Contract Times as either a specific date or a number of days]**
Original Contract Price: $ _____	Original Contract Times: Substantial Completion: _____ Ready for final payment: _____
[Increase] [Decrease] from previously approved Change Orders No. 1 to No. **[Number of previous Change Order]**: $ _____	**[Increase] [Decrease]** from previously approved Change Orders No.1 to No. **[Number of previous Change Order]**: 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: _____
[Increase] [Decrease] this Change Order: $ _____	**[Increase] [Decrease]** 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)	Accepted by Contractor
By:	_____	_____
Title:	_____	_____
Date:	_____	_____
	Authorized by Owner	Approved by Funding Agency (if applicable)
By:	_____	_____
Title:	_____	_____
Date:	_____	_____

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SECTION 01000

GENERAL REQUIREMENTS

PART 1 GENERAL

These General Requirements amend or supplement the Standard General Conditions and Supplemental General Conditions of the Construction Contract and other provisions of the contract documents as indicated herein. All provisions which are not so amended or supplemented shall remain in full force and effect.

1.01 DESCRIPTION OF PROJECT

This project consists of the removal and installation of new pumping equipment, piping, valves and associated electrical work.

A. The intent of the Drawings, Specifications and Contract is to provide for completion of the work in substantial compliance with the details as shown thereon and described herein. The Contractor shall furnish all labor, materials, equipment, tools, transportation and necessary supplies, and shall perform all operations required to complete the work in accordance with the Specifications, and the lines, grades and cross sections provided for on the Drawings of by authorization.

B. Proposed construction or requirement not covered by these Specifications will be covered by latest revision of the MDOT Standard Specifications for Construction.

1.02 SCOPE OF WORK

A. The work on this project will be satisfactorily completed and paid for at the contract unit prices as per Bid Schedule.

B. Construction of the **KI Sawyer WWTF Biosolids Handling Facility** consists of the following:

1. Removal of existing sludge pumping equipment and piping.
2. Installation of new sludge pumps, piping, valves, and fittings.
3. Removal of all existing RBC, HVAC, and electrical equipment and piping from the existing RBC building including removal of the building roof, concrete walkways, entry way, and other concrete.
4. Furnishing and constructing a pre-engineered metal building over the existing concrete building shell including new roof system and press room addition.
5. Installation of belt press and associated equipment including piping, fittings, valves, electrical and controls.
6. Site piping installation, grading, paving and concrete and general restoration.

1.03 STANDARD SPECIFICATIONS

A. Throughout these Specifications, reference is made to the Standard Specifications of the American Society for Testing Materials (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), American Standards Association (ASA), Federal Specifications, Michigan Manual of Uniform Traffic Control Devices (MMUTCD) and the Michigan Department of Transportation (MDOT) Standard

Specifications for Construction. Such reference will give the applicable serial or section designation. The latest Specifications and subsequent revisions shall apply in all cases.

1.04 DRAWINGS

A. Locations of all existing utilities shown on the Drawings are approximate. Contractor shall verify exact location of all utilities prior to construction.

B. The work to be done is as shown on the accompanying set of Drawings. These original Drawings may be supplemented by other Drawings furnished by the Contractor and approved by the Engineer. Additional Drawings may be prepared by the Engineer and supplied to the Contractor during the progress of the work as deemed by the Engineer to be necessary or expedient. These original and supplementary Drawings constitute the Drawings according to which the work is to be done.

C. The Contractor shall keep at the site of the work an approved copy of all Drawings and Specifications. The Engineer and Owner shall have access thereto at all times.

D. Drawings and Specifications are deemed essential parts of the Contract, and shall be construed as cooperative. Any work called for in the Drawings, not specifically mentioned or described in the Specifications nor particularly shown on the Drawings, is to be regarded as included under this Contract, the same as if fully set forth in the Specifications and exhibited on the Drawings. Figures or definite dimensions given on the Drawings or in the Specifications shall have precedence over dimensions taken by scaling.

E. In case of any inconsistency, omission, or conflict in either the Specifications or Drawings, or if in any part of the meaning of either or both shall be obscure, or uncertain, or in dispute, the Engineer shall decide as to the true intent. The Engineer's decision shall be final and binding in all cases.

1.05 SUBMITTALS

A. Within 30 days after notice to proceed, submit to the Engineer for approval, a minimum of four (4) sets of Drawings and/or catalog data of the materials to be furnished. Drawings will be returned to the Contractor within two (2) weeks after submittal.

B. No item and system shall be delivered to the site, or installed unless approved.

C. Unless otherwise provided, all items used shall be substantially the same as items of manufacture which, on the date of opening of bids, have been successful commercial use and operation for not less than one (1) year in projects and units of comparable size.

1.06 SHOP DRAWINGS

A. The Contractor shall furnish to the Engineer, as prescribed under the General Conditions, shop drawing of the various pieces of equipment to be incorporated into the work. Shop drawings will indicate design details, location(s) and function(s) in the project, operational details, and other such information as will indicate to the Engineer suitability for use under the Contract. The Engineer will review and approve all shop drawings, or request revisions or re-submittal as necessary to assure that (a) particular shop drawing(s) is (are) acceptable and conform(s) to the Specifications.

1.07 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall furnish and turn over to the Owner a complete manual fully describing the construction, operation, and maintenance of each piece of equipment and/or system installed under this Contract. Manual shall include one (1) copy of all approved shop drawings.

1.08 CERTIFICATIONS AND INSPECTION

A. The manufacturer and/or supplier shall furnish a certified statement that all materials, equipment, and products have been inspected and tested in accordance with the applicable standards. Identifiable class designations, weights or other marks shall be conspicuously cast, painted, or labeled on all materials, equipment, and products to indicate conformance to Specifications and correct location(s) on the Drawings.

B. Upon delivery of all materials, equipment and products to the job site, the Engineer or his representative will inspect and approve incorporation of same into the work. At the same time, the Engineer will receive a copy of the manufacturer's or suppliers certified statement. Cracked, broken, damaged or otherwise defective materials, equipment and products will not be incorporated into the work. Any item that is found to be defective or not in accordance to the Specifications and Drawings prior to and/or after incorporation into the work shall be removed by the Contractor and replaced at no expense to the Owner.

1.09 QUANTITIES

A. Quantities are approximate and will be used for comparison of bids only. Payment will be made based on actual measurements taken by the Engineer in conjunction with the Contractor during completion of the work. The Owner reserves the right to vary the quantities within the scope of the project. No adjustments in unit prices will be made if quantities are increased or decreased. Any other work called for by either Drawings or Specifications are defined as incidental or the cost shall be included in other bid unit prices of the Bid Proposal.

1.10 GENERAL REQUIREMENTS FOR MATERIALS AND WORKMANSHIP

A. In the Specifications there may be language where a particular material, product or piece of equipment is specified by reference to some particular make or type, or equal. It is not the intent to limit competition but to set up by such reference a standard of quality most easily understood and defined. If materials, products or equipment of another make or type other than that specified are offered by the Contractor, said materials, products or equipment will be given full consideration by the Engineer. The Engineer's decision will be final as to whether the materials, products or equipment offered are equal to those specified.

B. Unless otherwise stipulated in the Specifications, all workmanship, equipment, materials and products incorporated in the work covered by this contract are to be new and of the best grade for the purposed indicated. The Contractor shall provide for the Owner a one year guarantee on all his workmanship, materials, and products incorporated in the work. In addition, the Contractor shall furnish to the Owner for approval, the name of the manufacturer of machinery, mechanical and other equipment, which the Contractor contemplates installing, together with performance capacities and other pertinent information.

C. Where called for in the Specifications, the Contractor shall secure from the manufacturer for the Owner a guarantee that the materials, equipment, products and all parts there of shall be first class and free from defects. The manufacturer will, upon notice, without undue delay and expense to the Owner, make good or repair, the whole or part furnished to the project. The guarantee shall be good for a minimum of one year or the length of the manufacturer's warranty, whichever is greater. The guarantee will commence from the date of acceptance of the completed work. Guarantee and/or warranty provisions will be invoked upon discovery of failure and/or unfitness of any part of the work. Failure and unfitness shall be defined as any defect in shop drawing or manufacturer's design, materials, or workmanship.

D. The Contractor shall furnish suitable tools, building appliances, and employ competent labor to perform the work to be done. Any labor, tools, appliances that shall not in the judgment of the Engineer be suitable or competent to produce this result may be ordered from the project. Replacement or additional such labor, tools or appliances shall be substituted by the Contractor and will meet with the approval of the Engineer.

E. If not otherwise provided workmanship, equipment materials, and products called for in this Contract shall be furnished and performed in accordance with well-known established practice and standards recognized by Architects, Engineers and the trade. All building construction work alterations, repairs, or mechanical installations and appliances connected herewith shall comply with all the State Building Rules, Regulations, Local Ordinances and such other statutory provisions pertaining to this class of work. Such rules, regulations and local ordinances are to be considered as a part of these Specifications by reference.

1.11 TESTING AND SAMPLING

A. Where called for in the Specifications, samples of materials in the quantities named shall be submitted to the Engineer for approval. Where tests are required they shall be made at the expense of the Contractor, except as otherwise called for in the Specifications.

B. For materials covered by ASTM or Federal Specifications, unless otherwise stipulated, the required tests are to be made by the manufacturer. Certification of these tests shall be submitted to the Engineer by the manufacturer.

1.12 UTILITIES

A. The Contractor shall protect and save harmless from damage all utilities whether privately or publicly owned, above and below the ground surface which may be encountered during the prosecution of the work.

B. It will be the Contractor's responsibility to notify the utility companies of any possible interference with utility company service equipment.

C. The Contractor shall permit access to the owners of such utilities for the purpose of making necessary changes and adjustments to permit further prosecution of work under this contract. Necessity for such changes or alterations in utilities shall be made the basis of a claim for damages; however, an extension of time may be claimed if justified by the circumstances.

D. Unless otherwise provided in these specifications, the Contractor shall make his own arrangements for telephone, electricity, gas, water and sewer services for use during the construction of the work and shall pay for all connections, extensions and services thereof.

1.13 RELATIONS TO OTHER CONTRACTORS AND UTILITY FORCES

A. The Contractor shall conduct his operations as not to interfere with or injure the work of other contractors or adjacent force account work. The Contractor shall promptly make good any injury or damage which may be done to such work by him or his employees or agents. The Engineer shall decide which contractor or force, in cases of conflicting operations, shall cease work for the time being and which shall continue, or whether the work of both shall continue at the same time and in what manner.

B. The Contractor shall grant the other contractors and forces the necessary means of access to their work. Any decision which the Engineer may make as to the method and time of conducting work or the use of territory shall not be made the basis for any claims for damages.

C. The Contractor may, however, claim an extension of time if justified by the circumstances. Any difference of opinion or conflict of interest which may arise between the Contractor and other contractors or forces shall be determined and adjusted by the Engineer.

1.14 TIME AND SEQUENCE OF WORK

A. In general, it is the intention and understanding that the Contractor shall have control except where some particular sequence or method may be distinctly demanded by the Drawings, Specifications, or by the express provisions of this Contract as described in Section 01010. The Contractor shall have control over the following items:

1. Over the method of accomplishing the required results.
2. Over the method of protecting partially or wholly completed work.
3. Over the method, number of construction crews, and type of equipment used to construct and complete the work under this Contract as per Drawings and Specifications.

1.15 WORK HOURS

A. No work shall be done on Sunday except in case of emergency to protect life and property. Work shall be performed between the hours of 7 a.m. and 7 p.m. No night work shall be carried on which will require the presence of the Engineer or an inspector, except in case of emergency. The Contractor shall notify the Engineer a minimum of 24 hours prior to commencing Saturday Work. The Contractor shall notify the Owner and the Engineer in case of emergency Sunday or night work.

1.16 PROTECTION OF WORK

A. The Contractor shall assume full responsibility for loss or damage to the work during the entire construction period resulting from caving earth, storms, floods, frosts, and other adverse weather conditions, and from all other causes whatsoever not directly due to the acts of negligence of the Owner. The finished work shall be turned over to the Owner in good condition and repair. The Engineer may, however, make such reasonable requirements, in his judgment, be necessary for the proper and effective protection of work partially or wholly completed. The Contractor shall strictly conform to these requirements. The Contractor shall be responsible for such signing, barricading, fencing and lighting as may be necessary to protect the project in accordance with applicable Specifications referenced in the Contract Documents.

1.17 PROTECTION OF ADJOINING STRUCTURES

A. The Contractor shall assume all responsibility for the protection of all pavements, curbs, bridges, railroads, poles, other surface structures, water mains, sewers, telephone, and other underground services and structures along and near the work which may be affected by his operations. The Contractor shall indemnify, defend and save harmless the Owner against all damages or alleged damages to any such structure arising out of his work. The Contractor shall bear the cost of repair or replacement of any such structure damaged as a result of his operations. Damaged structures shall be repaired or replaced to the condition at the time of damage. Such repair or replacement shall be made by the Contractor as directed by the Engineer and/or Owner.

1.18 TREES AND SHRUBBERY

A. No trees and shrubbery of any kind shall be removed or destroyed by the Contractor without the permission of the Engineer or Owner. The Contractor will be held fully responsible for any damages caused by his work to adjoining trees and shrubs. Ample precautions shall be taken by the Contractor to protect such trees and shrubs that are to remain in place. Trees and shrubbery damaged by Contractor shall be replaced at Contractor's expense or equitable compensation at fair market value shall be paid to Owner. Trees and stumps which are to be removed shall be disposed of by the Contractor at his own expense. Tree branches which become broken shall be removed by cutting off flush with the trunk and the cut sealed with appropriate material.

1.19 PROTECTION AGAINST ACCIDENTS

A. The Contractor shall erect and maintain during the continuance of the work such signs, barriers, lights, and other protective devices as will effectually prevent any accidents in consequence of his work. The Contractor shall also furnish flag-persons as necessary to maintain traffic throughout the course of the work. The Contractor shall be liable for all accidents and damages occasioned in any way by his acts or negligence, or by the acts or negligence of his subcontractors, agents, employees, or workmen.

1.20 STORAGE OF MATERIALS

A. Materials and equipment distributed, stored and placed upon or near the site of the work shall not interfere with work being prosecuted by other contractors in the employ of the Owner, with surface drainage, with fire hydrant access, and not hinder the ordinary traffic of the streets and sidewalks.

1.21 CLEANUP AND RESTORATION

A. The Contractor shall at all times keep the premises free from accumulation of waste material or rubbish caused by his employees or work. Upon completion of construction, the Contractor shall clean up and leave in a neat condition all the premises which he has occupied during the construction period. Before the time of the final estimate, the Contractor shall remove from the premises all surplus excavation, debris, stakes, rubbish, and all unused materials together with all tools and equipment.

B. All existing features such as mail boxes, planters, retaining walls, landscaped yards, etc. disturbed by work shall be replaced to equal or greater condition.

C. The Contractor shall restore all trails, fences, water courses, culverts, sand, gravel, dirt, watermains, water services, water valve boxes, meter vaults, and all other items which

may be damaged during the course of construction. This item shall not be paid for separately, but shall be included in other pay items.

1.22 ACCEPTANCE OF WORK BY ENGINEER

A. All work shall be subject to the approval of the Engineer, who shall determine the amount, quality, acceptability and fitness of the several kinds of the work, materials to be furnished hereunder and shall decide all questions which may arise as to measurement of quantities and the fulfillment of the requirements of the Specifications.

1.23 RESPONSIBILITY FOR MATERIALS

A. All materials will be under the Contractor's care. The Contractor shall bear full responsibility for storage and installation. Any materials which are damaged, lost, or stolen shall be replaced in kind by the Contractor at no expense to the Owner. Contractor's responsibility for materials will remain in effect until such time as the Owner accepts the work.

1.24 EXISTING WATER AND SEWER SERVICES

A. It is the intent of the Drawings to show and locate existing water and sewer service laterals as close as possible. However, it shall be the Contractor's responsibility to field locate all services prior to construction in order to verify the proposed Drawings and intent. The Owner and/or its authorized representative may conduct such tests as deemed necessary by the Engineer in order to assist the Contractor in field verifying locations of services as exposed by the Contractor. The Contractor will not be reimbursed for any delays due to these tests and investigations.

1.25 PROGRESS SCHEDULE

A. Start work within 10 days after receiving Notice to Proceed of Contract or on or before the date designated as the starting date in the Detailed Progress Schedule, whichever is later. In no case, shall any work be commenced prior to receipt of formal notice to proceed by the Owner.

B. The entire project shall be completed on or before the date(s) as indicated in the Agreement.

C. The successful bidder(s) for the work covered in this proposal will be required to meet with the Engineer's and Owner's Representatives to work out a detailed progress schedule. The schedule for this meeting will be set within one week after the Agreement has been completed.

D. The named Subcontractor(s) for Specialty and/or Designated Items (if such items are designated in the proposal) which materially affect the work schedule, shall also be present at the scheduled meeting and they will be required to sign the Progress Schedule to indicate their approval of the scheduled dates of work set forth in the Progress Schedule.

E. The Engineer will arrange the time and place for the meeting.

F. The Progress Schedule shall include, as a minimum, the controlling work items for the completion of the project and the planned dates that these work items will be controlling operations. When specified in the Bidding Proposal, the date the project is to be opened to traffic as well as the final project completion date shall also be included in the Project Schedule.

G. If the Bidding Proposal specifies other controlling dates, these shall also be included in the Progress Schedule.

H. Failure on the part of the Contractor to carry out the provisions of the Progress Schedule, as established, shall be considered sufficient cause to assess damages.

1.26 PRECONSTRUCTION CONFERENCE

A. Before any work is commenced under the Contract, a pre-construction conference between representatives of the Contractor, Owner and Engineer shall be held at the Treatment Plant at a time and date mutually agreed upon, but no later than 10 working days after award of the Contract by Owner. At this time, the requirements of the Contract, proposed schedule, construction methods and the Contract Documents shall be discussed in order to obtain a mutual understanding of the overall construction.

B. he Contractor shall submit in writing at the pre-construction meeting the following information:

1. Proposed schedule of construction.
2. Proposed sources of material (if known).
3. List of Subcontractors.
4. Superintendent of the project.
5. Foreman in charge of the job site.
6. Emergency phone numbers for Contractor.

1.27 NOTICE TO PROCEED

A. After the pre-construction conference is held, after receipt of the required bonds and insurances and approved construction schedule, the Engineer will issue a Notice to Proceed on the project. Such notice shall be issued in duplication and the Contractor shall affix to one copy the date received and his signature and return that copy to the Owner. The Contractor shall commence work on the project within 10 days of the receipt of the Notice to Proceed. Should the Owner fail to issue such Notice to Proceed, the Owner will inform the Contractor as to why the Owner is not prepared to proceed.

1.28 CONTRACTOR RESPONSIBILITY FOR HOLIDAY, NIGHT AND WEEKEND PROBLEMS

A. It shall be the Contractor's responsibility to keep all construction areas accessible to the public when streets are not closed. It shall be the Contractor's responsibility to notify the Engineer and the Marquette County Sheriff's Department of a person responsible to be on call during weekends, holidays, and during the night. Failure to designate a responsible person will result in a penalty to the Contractor. If a problem results in no action by the Contractor during the weekend, holiday, or night hours within three hours of notification by the Engineer or Marquette County Sheriff's Department, or if the responsible party cannot be reached, the Contractor will be assessed all costs incurred by the KI Sawyer WWTP plus $100 damages that will be deducted from the progress payments.

1.29 DUST CONTROL

A. Due to close geographic location of Project to other off-site facilities and residential homes, take special care in providing and maintaining temporary roadways, Owner's

existing roads, haul roads, and public roads used for construction operations in clean, dust free conditions at all times.

B. Comply with local environmental regulations for dust control and directions of Engineer. If Contractor's dust control measures are considered inadequate by Engineer, Engineer will require Contractor to take additional dust control measures.

1.30 PAYMENT

A. All work described in Section 1.00 shall not be paid for separately, but shall be included in other pay items.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01010

PROJECT SUMMARY AND WORK SEQUENCE

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

A. Work of this Contract entails the installation of a biosolids dewatering belt press and associated equipment including removal of existing RBC equipment, building demolition, construction of a pre-engineered steel building, site piping installation, electrical and controls, and general site restoration.

1.02 WORK BY OWNER

A. Not Applicable

1.03 WORK BY OTHERS

A. The Owner has purchased the belt press and other ancillary equipment from Or-Tec Incorporated. Information on the equipment provided in included in Appendix A.

1. The Contractor shall be responsible for receiving this equipment onsite and installation per the plans and specifications.

1.04 OWNER SUPPLIED PRODUCTS

A. The Owner has procured the belt press and other major equipment required for installation as part of this project. The equipment submittal information is included in the Appendix of this Project Manual.

1.05 MILESTONES AND WORK SEQUENCE

A. All building exterior work and all site work including final restoration shall be completed on or before November 1, 2023.

1. Failure to comply with this deadline shall result in liquidated damages against the Contractor as stated in the agreement.

B. All work under this contract shall be completed on or before December 5, 2023.

1. Failure to comply with this deadline shall result in liquidated damages against the Contractor as stated in the agreement.

C. Construct work in stages to accommodate operation of existing facilities during construction period; coordinate Construction Progress Schedule and operations with Owner and Engineer. Work must be staged so that the existing wastewater treatment plant can remain in at a minimum partial operation during the work.

D. Any outage in pumping must be approved by the Owner and Engineer prior to commencing. Care must be taken to avoid pumping outages or reduction in capacity during wet weather/high flow events.

E. Contractor shall identify in Construction Progress Schedule the number of crews that will be working on the project at all times.

F. Construction Progress Schedule shall be submitted as specified herein except that the schedule must be approved by Owner prior to Notice-to-Proceed.

1.06 CONTRACTOR'S USE OF PREMISES

A. Contractor shall, at all times, conduct operations to ensure least inconvenience to Owner, other contractors, general public, and operation of existing wastewater facility.

B. Coordinate use of premises under direction of Engineer and Owner.

C. Obtain and pay for use of additional storage or work areas needed for operations at no additional cost to Owner.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01130

ALTERNATE BID ITEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes administrative and procedural requirements governing Alternates.

1.02 DEFINITIONS

A. An alternate is an amount proposed by Bidder and stated on Bid Form for certain work defined in Bidding Requirements that may be added to or deducted from Contract Price if Owner decides to accept corresponding change in either amount of construction to be completed, or in materials, equipment or installation methods described in Contract Documents.

B. Add or deduct for each alternate is net addition or deduction from Contract price to incorporate Alternate into work. No other adjustments will be made to contract price.

C. "Provide" shall mean furnish and install.

D. "Furnish" shall mean that Contractor assumes all cost associated with procuring, delivering and unloading equipment or materials to the job site.

E. "Install" shall include all cost associated with assembling and connecting equipment and material at the job site.

1.03 PROCEDURES

A. Coordination:

1. Modify or adjust affected adjacent work as necessary to completely and fully integrate work of alternate in project.

2. Include as part of each alternate, miscellaneous devices, accessory objects and similar items incidental to or required for complete installation whether or not indicated as part of alternate.

B. Execute accepted alternates under same conditions as other work of Contract.

1.04 DESCRIPTION OF PROJECT ALTERNATES

A. Alternate Add 'A': Remove RBC Basins

1. Alternate Add for the removal of the existing RBC Basins.

2. Provide a Lump Sum cost for all removal and restoration work as shown on the plans and specifications.

3. Provide a breakdown of the cost for this work on the Alternate Add 'A' Bid Schedule.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01295

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SUMMARY

A. Submit Schedule of Values allocated to various portions of Work as required by General Conditions.

B. Upon request of Engineer, support values with data substantiating their correctness.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Type schedule on 8-1/2 in. by 11 in. white paper; Contractor's standard forms and automated printout will be considered for approval by Engineer upon Contractor's request. Identify schedule with following:

1. Project title and location.
2. Engineer and Engineer's Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Identify installed value of component parts of Work in sufficient detail to serve as basis for computing values for progress payments during construction.

C. Use general table of contents of this Project Manual to establish format for listing component items in schedule:

1. Identify each line item with number and title of respective Specification, division and section.
2. If Project consists of multiple structures, break down schedule by structure.

D. Provide separate listing for General Requirement (Division 1) items, such as bonds, insurance premiums, mobilization, field supervision and layout, construction facilities and temporary controls, contingency allowance, construction schedule, O&M data, record drawings, and submittals.

E. For each Specification division, list sub-values of major materials, equipment or operations under division.

F. For Various Portions of Work:

1. Each item shall include directly proportional amount of Contractor's overhead and profit. For items on which progress payments will be requested for stored materials, break down value into:
    a. Cost of materials, delivered and unloaded, with taxes paid.
    b. Total installed value including Contractor's overhead and profit.

2. Submit sub-schedule for each separate stage of Work.

G. Sum of values listed in schedule shall equal total Contract sum.

1.03 SUBSCHEDULE OF UNIT MATERIAL VALUES

A. Submit subschedule of unit costs and quantities for following.

1. Products on which progress payments will be requested for stored products.

B. Form of submittal shall parallel that of Schedule of Values with each item identified same as line item in Schedule of Values.

C. Unit quantity for bulk materials shall include nominal allowance for waste.

D. Unit values for materials shall be broken down as follows.

1. Cost of material, delivered and unloaded at site, with taxes paid.

2. Installation costs, including Contractor's overhead and profit.

E. Installed unit value multiplied by quantity listed shall equal cost of that item in Schedule of Values.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01330

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including the following:

1. Contractor's construction schedule.
2. Submittal schedule.
3. Daily construction reports.
4. Shop drawings:
   a. Includes technical data and Drawings specifically prepared for this Project, including fabrication and installation Drawings, diagrams, data sheets, schedules, templates, patterns, reports, instructions, design mix formulas, measurements, and similar information not in standard printed form.
   b. Standard catalog type information prepared without specific reference to Project is not considered as Shop Drawing.
5. Substitutes and "Or Equal" items:
   a. Includes material or equipment described in Paragraph 6.05 of General Conditions which CONTRACTOR requests ENGINEER to accept, after Effective Date of the Agreement.
6. Product Data:
   a. Includes standard catalog type printed information on manufactured materials, equipment and systems that has not been specifically prepared for this Project, including manufacturer's specifications, catalog cuts, standard wiring diagrams, printed performance curves, mill reports, and standard color charts.
7. Samples:
   a. Includes fabricated and manufactured physical examples of materials, products, and units of work, includes complete units, partial cuts of manufactured or fabricated work, swatches showing color, texture, and pattern, and units of work to be used for independent inspection and testing.
8. Test Results:
   a. Includes source and field quality inspection and test reports, actual performance curves, and certification of results prepared specifically for equipment, material, and systems provided for this Project.
   b. Standard catalog charts or standard test results are considered Product Data.

9. Operations and Maintenance Data:

    a. Includes information and directions for operating and maintaining equipment provided and installed for this Project. May be standard for equipment or prepared specifically for this Project.

10. Quality Assurance Submittals

11. Miscellaneous Submittals:

    a. Work-related submittals that do not fit in previous categories, includes schedules, photographs, guarantees, warranties, certifications, maintenance agreements, workmanship bonds, survey data and reports, physical work records, copies of industry standards, field measurement data, extra materials, keys, and similar information, devices and materials applicable to Work.

B. Administrative Submittals: Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but not limited to the following:

1. Permits

2. Applications for Payment

3. Performance and Payment Bonds

4. Insurance Certificates

5. List of Subcontractors

1.02 SUBMITTAL PROCEDURES

A. Scheduling:

1. Contractor is not required to submit preliminary or final schedule of Shop Drawing and sample submittals as required in Paragraph 6.17 of General Conditions.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.

2. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.

    a. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.

3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for re-submittals.

    a. Allow 2 weeks for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.

b. If an intermediate submittal is necessary, process the same as the initial submittal.

c. Allow 2 weeks for reprocessing each submittal.

d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

C. Submittal Preparation: Place a permanent label or title block on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. Provide a space approximately 4 by 5 inches (100 by 125 mm) on the label or beside the title block on Shop Drawings to record the Contractor's review and approval markings and the action taken.

2. Include the following information on the label for processing and recording action taken.

a. Project name

b. Date

c. Name and address of the Engineer

d. Name and address of the Contractor

e. Name and address of the Subcontractor

f. Name and address of the supplier

g. Name of the manufacturer

h. Number and title of appropriate Specification Section

i. Drawing number and detail references, as appropriate

D. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. The Engineer will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Documents requirements.

2. Transmittal Form: Use AIA Document G810.

3. Electronic Submittals: PDF Format, as approved by Engineer.

E. Re-submittal Preparation:

1. Comply with requirements described in Submittal Preparation above, and in addition:

a. Identify on the transmittal form submittal is re-submission.

b. Make corrections or changes in submittals required by ENGINEER'S notations on returned submittal.

c. Respond to ENGINEER'S notations:

1) On transmittal or separate page attached to CONTRACTOR'S re-submission transmittal, answer or acknowledge in writing notations or questions indicated by ENGINEER on ENGINEER'S transmittal form returning reviewed submission to CONTRACTOR.

2) Identify each response by question or notation number established by ENGINEER.

3) If CONTRACTOR does not respond to each notation or question, re-submission will be returned without action by ENGINEER until CONTRACTOR provides written response to ENGINEER'S notations or questions.

d. CONTRACTOR initiated revisions or variations.

1) On transmittal form, identify variations or revisions from previously reviewed submittal, other than those called for by ENGINEER.

2) ENGINEER'S responsibility for variations or revisions is established in Article 6.17 of General Conditions.

1.03 CONTRACTOR'S PROGRESS SCHEDULE

A. Bar-Chart Schedule: Prepare a fully developed, horizontal bar-chart-type, contractor's construction schedule. Submit at preconstruction meeting.

1. Provide a separate time bar for each significant construction activity. Provide a continuous vertical line to identify the first working day of each week.

2. Within each time bar, indicate estimated completion percentage in 10 percent increments. As Work progresses, place a contrasting mark in each bar to indicate Actual Completion.

3. Prepare the schedule on a sheet, or series of sheets, of stable transparency, or other reproducible media, of sufficient width to show data for the entire construction period.

4. Secure time commitments for performing critical elements of the Work from parties involved. Coordinate each element on the schedule with other construction activities; include minor elements involved in the sequence of the Work. Show each activity in proper sequence. Indicate graphically the sequences necessary for completion of related portions of the Work.

5. Coordinate the Contractor's Construction Schedule with the list of subcontracts, Submittal Schedule, progress reports, payment requests, and other schedules.

6. Indicate completion in advance of the date established for Substantial Completion. Indicate Substantial Completion on the schedule to allow time for the Engineer's procedures necessary for certification of Substantial Completion.

B. Phasing: On the schedule, show how requirements for phased completion to permit Work by separate Contractors and partial occupancy by the Owner affect the sequence of Work.

C. Work Stages: Indicate important stages of construction for each major portion of the Work, including submittal review, testing, and installation.

D. Area Separations: Provide a separate time bar to identify each major construction area for each major portion of the Work. Indicate where each element in an area must be sequenced or integrated with other activities.

E. Cost Correlation: At the head of the schedule, provide a cost correlation line, indicating planned and actual costs. On the line, show dollar volume of Work performed as of the dates used for preparations of payment requests.

F. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with scheduled dates. Post copies in the Project meeting room and temporary field office.

1. When revisions are made, distribute 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 construction

G. Schedule Updating: Revise the schedule after each meeting, event, or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.04 SUBMITTAL SCHEDULE

A. After development and acceptance of the Contractor's Construction Schedule, prepare a complete schedule of submittals. Submit the schedule within 10 days of the date required for submittal of the Contractor's Construction Schedule.

1. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the lit of products as well as the Contractor's Construction Schedule.

2. Prepare the schedule in chronological order. Provide the following information:

a. Schedule date for the first submittal.

b. Related Section number.

c. Submittal category (Shop Drawings, Product Data, or Samples).

d. Name of the subcontractor.

e. Description of the part of the Work covered.

f. Scheduled date for re-submittal.

g. Scheduled date for the Engineer's final release or approval.

B. Distribution: Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute 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 construction activities.

C. Schedule Updating: Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

1.05 DAILY CONSTRUCTION REPORTS

A. Prepare a daily construction report recording the following information concerning events at the site, and submit duplicate copies to the Engineer at weekly intervals:

1. List of subcontractors at the site
2. Approximate count of personnel at the site
3. High and low temperatures, general weather conditions
4. Accidents and unusual events
5. Meetings and significant decisions
6. Stoppages, delays, shortages, and losses
7. Meter readings and similar recordings
8. Emergency procedures
9. Orders and requests of governing authorities
10. Change Orders received, implemented
11. Services connected, disconnected
12. Equipment or system tests and startups
13. Partial Completions, occupancies
14. Substantial Completions authorized

1.06 SHOP DRAWINGS

A. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.

B. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:

1. Dimensions.
2. Identification of products and materials included by sheet and detail number.
3. Compliance with specified standards.
4. Notation of coordination requirements.
5. Notion of dimensions established by field measurement.
6. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8 ½ x 11 inches (215 by 280 mm) but no larger than 36 by 48 inches (890 by 1220 mm).
7. Initial Submittal: Submit one correctable, translucent, reproducible print and one blue or black line print for the Engineer’s review. The Engineer will return the reproducible print.
8. Initial Submittal: Submit 2 blue or black line prints for the Engineer’s review. The Engineer will return 1 print.

9. Final Submittal: Submit 3 blue or black line prints; submit 5 prints where required for maintenance manuals. The Engineer will retain 2 prints and return the remainder.

10. Final Submittal: Submit 3 blue or black line prints and 2 additional prints where required maintenance manuals, plus the number of prints needed by the Engineer for distribution. The Engineer will retain 2 prints and return the remainder.

    a. One of the prints returned shall be marked up and maintained as a "Record Document".

11. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

1.07 PRODUCT DATA

A. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.

1. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required mark copies to indicate the applicable information. Include the following information:

    a. Manufacturer's printed recommendations

    b. Compliance with trade association standards

    c. Compliance with recognized testing agency standards

    d. Application of testing agency labels and seals

    e. Notation of dimensions verified by field measurement

    f. Notation of coordination requirements

2. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.

3. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.

4. Submittals: Submit 2 copies of each required submittal; submit 4 copies where required for maintenance manuals. The Engineer will retain one and will return the other marked with action taken and corrections or modifications required.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

5. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.

    a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.

    b. Do not permit use of unmarked copies of Product Data in connection with construction.

B. Samples.

1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
2. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Engineer's sample. Include the following:
    a. Specification Section number and reference
    b. Generic description of the Sample
    c. Sample source
    d. Product name or name of the manufacturer
    e. Compliance with recognized standards
    f. Availability and delivery time
3. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    a. Where variation in color, pattern, texture, or other characteristics is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variations.
    b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    c. Refer to other Sections for Samples to be returned to the contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.
    d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.
4. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
    a. The Engineer will review and return preliminary submittals with the Engineer's notation, indicating selection and other action.
5. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit 3 sets. The Engineer will return one set marked with the action taken.
6. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.
    a. Unless noncompliance's with Contract Document provisions are observed, the submittal may serve as the final submittal.

b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

C. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

1. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

2. Comply with submittal requirements to the fullest extent possible. Process transmittal forms to provide a record of activity.

1.08 QUALITY ASSURANCE SUBMITTALS

A. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

B. Certifications: Where other Sections of the Specifications require certification that a product, material or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

1. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

1.09 TEST RESULTS

A. Preparation:

1. Identify each test by Specification section and type of test.

B. Submittals:

1. Submit 3 copies.

2. Submittal is to confirm that results of tests verify materials, products, and systems comply with Contract Documents and are not for approval.

C. Distribution:

1. Unless otherwise required in the Contract Documents, test results shall be submitted to ENGINEER'S field office or if ENGINEER has no field office, to ENGINEER'S office.

1.10 OPERATING AND MAINTENANCE (O&M) DATA

A. Organize operations and maintenance information into suitable sets of manageable size, and bind into individual binders properly identified and indexed (thumb-tabbed). Include emergency instructions, spare parts listing, copies of warranties, wiring diagrams, recommended "turn-around" cycles, inspection procedures, Shop Drawings, Product Data, and similar applicable information.

1. Shop Drawings and other submittals included in O&M data shall be corrected to include, in same format and style as original submittal, review comments.

B. Binders: Heavy duty 2 inch, 3-ring vinyl covered; include pocket folders for folded sheet information. Mark identification on front and spine of each binder.

C. Submit after equipment requiring O&M data has been returned “Approved” or “Approved as Noted”.

D. Submit 2 copies of each manual.

1.11 ENGINEER’S ACTION

A. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly.

1. Compliance with specified characteristics is the Contractor’s responsibility.

B. Action Stamp.

1. Approved.

a. Final Unrestricted Release: When submittals are marked as “Approved”, work covered by submittal may proceed provided it complies with Contract Documents. Acceptance of Work depends on that compliance.

2. Marking: Approved As Noted.

a. Final-But-Restricted Release: When submittals are marked as “Approved With Noted Exceptions”, Work covered by submittal may proceed provided it complies with ENGINEER’S notations or corrections on submittal and with Contract Documents. Acceptance of Work depends on that compliance. Re-submittal not required.

3. Marking: Not Approved.

a. Submittal Not Accepted: When submittals are marked as “Not Approved”, do not proceed with Work covered by submittal. Work covered by submittal does not comply with Contract Documents.

b. Prepare new submittal for different material or equipment supplier or different product line or material of same supplier complying with Contract Documents.

4. Marking: Revise and Resubmit.

a. Returned for Re-submittal: When submittals are marked as “Revise and Resubmit”, do not proceed with Work covered by submittal. Do not permit Work covered by submittals to be used as Project site or elsewhere where Work is in progress.

b. Revise submittal or prepare new submittal in accordance with ENGINEER’s notations in accordance with re-submittal requirements of this section. Resubmit without delay. Repeat if required to obtain different action marking.

C. Unsolicited Submittals: The Engineer will return unsolicited submittals to the sender without action.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 01400

QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This section includes administrative and procedural requirements for quality control services.

B. Quality control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities. They do not include contract enforcement activities performed by Engineer.

C. Inspection and testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.

D. Requirements of this Section relate to customized fabrication, or production or use of aggregate materials, and installation procedures.

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 inspections, tests, and related actions do not limit Contractor's quality control procedures that facilitate compliance with Contract Document requirements.

3. Requirements for Contractor to provide quality control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

1.03 RESPONSIBILITIES

A. Contractor Responsibilities: Unless otherwise indicated as the responsibility of another identified entity, Contractor shall provide inspections, tests, and other quality control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. Costs for these services are the responsibility of the Contractor.

1. Where individual Sections specifically indicate that certain inspections, tests, and other quality control services are the Contractor's responsibility, the Contractor shall employ and pay a qualified independent testing agency to perform quality control services.

2. Where individual Sections specifically indicate that certain inspections, tests, and other quality control services are the Owner's responsibility, the Owner will employ and pay a qualified independent testing agency to perform those services.

B. Retesting: The Contractor is responsible for retesting where results of inspections, tests, or other quality control services prove unsatisfactory and indicate noncompliance with Contract Document requirements, regardless of whether the original test was Contractor's responsibility.

1. The cost for retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.

C. Associated Services: Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include, but not limited to, the following:

1. Provide access to the Work.

2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.

3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.

4. Provide facilities for storage and curing of test samples.

5. Deliver samples to testing laboratories.

6. Provide the agency with a preliminary design mix proposed for use for materials mixes that require control by the testing agency.

7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency: The independent agency engaged to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Engineer and the Contractor in performance of the agency's duties. The testing agency shall provide qualified personnel to perform required inspections and tests.

1. The agency shall notify the Engineer and the Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. The agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract Documents or approve or accept any portion of the Work.

3. The agency shall no perform any duties of the Contractor.

E. Coordination: Coordinate the sequence of activities to accommodate required services with a minimum of delay. Coordinate activities to avoid the necessity of removing and replacing construction to accommodate inspections and tests.

1. The Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.04 SUBMITTALS

A. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Engineer. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.

1. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
    a. Date of issue.
    b. Project title and number.
    c. Name, address, and telephone number of testing agency.
    d. Dates and locations of samples and tests or inspections.
    e. Names of individuals making the inspection or test.
    f. Designation of the Work and test method.
    g. Identification of project and Specification Section.
    h. Complete inspection or test data.
    i. Test results and an interpretation of test results.
    j. Ambient conditions at the time of sample taking and testing.
    k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    l. Name and signature of laboratory inspector.

1.05 QUALITY ASSURANCE

A. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories that specialize in the types of inspections and tests to be performed. The individuals performing the field inspection and laboratory testing will hold the applicable certifications to perform these tasks.
    1. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

A. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

END OF SECTION

SECTION 01457

TESTING PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Hydrostatic pressure testing.
2. Low pressure air testing.
3. High pressure air testing.

B. Other sections identify new piping systems to be tested, identify type of test to be performed, specify test pressure, and reference this section for detailed testing requirements.

1.02 SUBMITTALS

A. Test report for each piping system tested.

B. Submit in accordance with Section 01330.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 GENERAL

A. Pressure test in presence of ENGINEER.

B. Furnish water required for testing and provide necessary piping connections between section of piping being tested and nearest available source of water or air supply, together with test pressure equipment, meters, pressure gauge, and other equipment, materials, and facilities necessary to perform specified tests.

C. Provide bulkheads, flanges, valves, bracing, blocking or other temporary sectionalizing devices that may be required.

D. Remove temporary sectionalizing device after tests complete.

E. Perform tests on exposed piping after piping completely installed, including supports, hangers, and anchors.

F. Perform tests on piping before insulation installed.

G. Perform tests on piping that is clean and free of dirt, sand or other foreign material.

H. Plug pipe outlets with test plugs. Brace each plug securely to prevent blowouts.

I. Add test fluid slowly.

J. Include regulator set to avoid over-pressurizing and damaging piping.

K. Perform pressure testing in accordance with local, state, and federal requirements.

L. Cost of testing including water, personnel, equipment, and materials shalt be CONTRACTOR'S responsibility.

M. Correct leaks or defects and retest at no additional cost to OWNER.

3.02 HYDROSTATIC PRESSURE TESTING

A. Perform hydrostatic pressure testing for piping systems identified in other sections to be hydrostatically pressure tested. Test pressure shall be as specified in other sections.

B. Open vents at high points to purge air pockets while piping system is filling. Venting may also be provided by loosening flanges or with equipment vents.

C. Testing:

1. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of test.

2. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to ENGINEER.

3. Maintain test pressure for sufficient length of time to permit ENGINEER to observe piping under test but not less than 2 hrs.

4. If repairs required, repeat pressure test until pipe installation conforms to specified requirements and is acceptable to ENGINEER.

D. With exception of buried piping with mechanical joints or push-on joints, piping systems shall show no visual evidence of weeping or leaking.

E. Maximum allowable leakage for buried piping with mechanical joints or push-on joints is as follows.

$$L = \frac{ND\,P^{1/2}}{7{,}400}$$

Where:
L = Leakage, gallons per hr.
N = Number of joints under test
D = Nominal diameter of piping, in.
P = Average pressure during test, lbs. per sq in.

3.03 LOW PRESSURE AIR TESTING

A. General:

1. Perform low pressure air testing for gravity sewer and drainage piping systems identified in other sections to be low pressure air tested.

2. Air Test Procedure: Test pipes between adjacent manholes. Test time for air pressure to drop 1 psig.

   a. For pipes 4 in. through 24 in.: Comply with Table 1.

   b. Pipe diameters above 36 in. will not be accepted by means of low pressure air test. In all cases, ignore length of laterals.

TABLE 1: LOW PRESSURE AIR TEST TIME
(Specification time (min:sec) required for loss of air pressure from 3.5 psia to 2.5 psia for size and length of pipe indicated)

A	B	C	D	E	F
Pipe Dia (in)	**Time/Ft up to Length in Column C (sec)**	**Test Length (ft)**	**Test Time for Length Between Columns C & E (min:sec)**	**Length Time In Column F Applies (ft)**	**Time/Ft for Total Length (sec)**
4	0.18	636	1:54	1,432	0.08
6	0.40	424	2:50	955	0.18
8	0.71	318	3:47	716	0.32
10	1.11	255	4:43	573	0.49
12	1.60	212	5:40	477	0.71
15	2.50	170	7:05	382	1.11
18	3.62	141	8:30	318	1.61
21	4 .92	121	9:55	273	2.19
24	6.42	106	11:20	239	2.85
27	8.14	94	12:45	212	3.62
30	10.00	85	14:10	191	4.44
33	12.14	77	15:35	174	5.40
36	14.37	71	17:00	159	6.39

B. Preparation:

1. Isolate pipe section to be tested by plugging each end with air tight plugs. Plug ends of branches, laterals and wyes which are to be included in test section.

2. Brace plugs to prevent slippage and blowout due to internal pressure.

3. One plug shall have inlet tap or other provision for connecting supply air hose. Connect one end of air hose to plug used for a·1r inlet; other end to portable air control equipment.

4. Air control equipment shall consist of valves and pressure gauges to control rate at which air flows into test section and gauges to monitor air pressure inside pipe.

5. Connect air hose between source of compressed air and control equipment.

C. Testing:

1. If pipe to be tested is submerged in groundwater, determine height of groundwater above spring line of pipe at each end of test section and compute

average. For every foot of groundwater above pipe's spring line, increase gauge test pressures by 0.43 lbs/sq in.

2. Add air slowly to test section until pressure inside pipe is raised to 4.0 psig greater than average back pressure of groundwater that may be over pipe.

3. After pressure of 4.0 psig obtained, control supply of air so internal pressure maintained between 3.5 and 4.0 psig (above average groundwater back pressure) for minimum of 2 min to allow temperature of air to come into equilibrium with temperature of pipe walls.

4. Determine rate of air lost by time pressure drop method.

   a. After temperature stabilized for 2-min period, disconnect air supply. Allow pressure to decrease to 3.6 psig. At this pressure, start stopwatch to determine time required for pressure to drop 1 psig. Time required for loss of 1.0 psig is then compared to Table 1. !f time is equal or greater than times indicated in table, test shall be acceptable.

3.04 HIGH PRESSURE AIR TESTING

A. Perform high pressure air testing for piping systems as specified in other sections. Test pressure shall be as specified in other sections.

B. Perform preliminary test at not greater than 25 psig. Examine for leakage at joints with soap solution and visual detection of soap bubbles. Correct visible leaks.

C. Perform final test at test pressure. Pressure in system shall be gradually increased and in small increments until test pressure reached. Test pressure shall be maintained for minimum of 1O min and additional time necessary to conduct soap bubble examination of each joint for leakage.

D. Piping system shall show no evidence of leakage.

3.05 TEST REPORT

A. Prepare and submit test report for each piping system tested. Include following information in test report.

1. Date of test
2. Description and identification of piping system tested
3. Type of test performed
4. Test fluid
5. Test pressure
6. Type and location of leaks detected
7. Corrective action taken to repair leaks
8. Results of retesting

END OF SECTION

SECTION 01700

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Protecting installed construction.

F. Project record documents.

G. Operation and maintenance data.

H. Spare parts and maintenance products.

I. Product warranties and product bonds.

1.02 COORDINATION

A. Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

B. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

C. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

D. Make provisions to accommodate items scheduled for later installation.

E. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but not limited to, the following:

1. Preparation of schedules.

2. Installation and removal of temporary facilities.

3. Delivery and processing of submittals.

4. Progress Meetings.

5. Project closeout activities.

1.03 CLOSEOUT PROCEDURES

A. Submit written certification that Contract documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.

B. Provide submittals to Engineer required by authorities having jurisdiction.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.04 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces.

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Clean debris from roofs, gutters, downspouts, and drainage systems.

E. Clean site; sweep paved areas, rake clean landscaped surfaces.

F. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.05 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner seven (7) days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation; belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative and Contractor's personnel in accordance with manufacturers' instructions.

G. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

1.06 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel prior to final inspection.

B. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

C. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at agreed time and location.

D. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.07 PROTECTING INSTALLED CONTSRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.08 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Manufacturer’s instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:

1. Manufacturer’s name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:

1. Measured depths of foundations in relation to finish main floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract Drawings.

G. Submit documents to Architect/Engineer.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit data on 8 ½ x 11 inch text pages, bound inside 3-ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger Drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:

1. Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
2. Part 2: Operation and maintenance instructions, include the following:
   a. Significant design criteria.
   b. List of equipment.
   c. Parts list for each component.
   d. Operating instructions.
   e. Maintenance instructions for equipment and systems.
   f. Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
3. Part 3: Project documents and certificates, including the following:
   a. Shop Drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Photocopies of warranties.

1.10 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to and place in location as directed by Owner.

1.11 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:

1. For equipment or component parts of equipment, put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.12 MEASUREMENT AND PAYMENT

A. All work described in this section shall be considered incidental to other project items and no specific payment shall be made in this regard.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 02218

FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Finish grade subsoil and proof rolling.

B. Salvage topsoil and screen.

C. Place, level and compact topsoil.

1.02 SAMPLES

A. Submit 10 lb. sample of imported fill to testing laboratory in air-tight containers, as directed by Engineer.

1.03 PROTECTION

A. Protect landscaping and other features remaining as final work.

B. Protect existing structures, fences, roads, sidewalks, paving, and curbs.

PART 2 PRODUCTS

2.01 MATERIALS

A. Topsoil: The Contractor shall screen the topsoil prior to placement.

B. Imported topsoil must be approved before use.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify site conditions and note irregularities affecting work of this Section.

3.02 SUBSOIL PREPARATION

A. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, in excess of ½ inch in size.

B. Scarify subgrade to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.03 PLACING TOPSOIL

A. Place topsoil in areas where seeding, sodding and plantings are scheduled.

B. Use topsoil in relatively dry state. Place during dry weather.

C. Fine grade topsoil eliminating rough or low areas. Maintain levels, profiles, and contours of subgrade.

D. Remove stone, roots, grass, weeds, debris, and foreign material while spreading.

E. Manually spread topsoil around trees, plants and building to prevent damage.

F. Lightly compact placed topsoil.

3.04 TOLERANCES

A. Top of Topsoil: Plus, or minus ½ inch.

3.05 SCHEDULE OF LOCATIONS

A. The following paragraphs identify compacted topsoil thickness for various locations:

1. Seeded Grass: 4 inches.

2. Sod: 3 inches.

END OF SECTION

SECTION 02220

SITE CLEARING, REMOVAL AND ABANDONMENT OF UTILITIES AND STRUCTURES

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes demolition and removal of designated structures; removal of surface debris; removal of pavement, curb and sidewalk; removal of trees and shrubs; removal and storage of topsoil; removal of existing drainage structures and catch basin leads; removal and abandonment of sanitary and storm sewer piping and other buried piping; removal as disposal demolished materials from project site; protection of items to remain and list of material or equipment to be salvaged and preserved for Owner.

1.02 RECORD DRAWINGS

A. Accurately record locations of capped utilities and subsurface obstructions.

1.03 SEQUENCING AND SCHEDULE

A. Include site clearing and removal and abandonment schedule on Detailed Progress Schedule.

B. Schedule work to coincide with new construction.

1.04 PROCEDURES

A. All sanitary sewer, storm sewer, watermain and other piping which is no longer in service shall be removed or abandoned in accordance with the latest revision of the MDOT Standard Specifications for Construction as modified herein.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting.

B. Identify waste and salvage areas for placing removed materials.

C. Locate and identify existing utilities to remain.

3.02 PREPARATION

A. Erect and maintain temporary barriers and security devices, including warning signs and lights, and similar measures, for protection of the public, Owner, Contractor’s employees and existing improvements to remain.

B. Protect existing landscaping materials, trees, appurtenances, structures and utilities during demolition and removal operations.

C. Repair or replace trees or shrubs damaged by construction operations at no additional cost to the Owner.

D. Prevent movement or settlement of adjacent structures. Provide bracing and shoring.

E. Mark location of utilities.

F. Protect bench marks, survey control points, and property corners from damage or displacement.

G. Salvage marketable timber.

3.03 DEMOLITION REQUIREMENTS

A. Conduct demolition to minimize interference with adjacent structures and utilities.

B. Cease operations immediately when adjacent structures appear to be in danger. Notify authority having jurisdiction and the Engineer. Do not resume operations until directed.

C. Conduct operations with minimum interference to public or private accesses. Maintain egress and access from adjacent structures at all times.

D. Obtain written permission from adjacent property owners when demolition equipment will traverse, infringe upon or limit access to their property.

E. Sprinkle work with water to minimize dust. Provide hoses and water connections required for this purpose.

F. Disconnect, cap and identify designated utilities within demolition areas.

G. Remove foundation walls and footings to minimum of 2 feet below finished grade.

H. Remove concrete slabs on grade.

I. Empty buried tanks or concrete basins located within demolition area, create minimum opening of 2 square feet in bottom of structure, remove buried tanks, components, and piping from site. Fill with sand or fine gravel and cover with fill.

J. Remove materials to be reinstalled or retained in manner to prevent damage.

K. Backfill areas resulting from demolition in accordance with Specifications.

L. Rough grade and compact areas affected by demolition to maintain site grades and contours.

M. Continuously clean up and remove demolished materials from site. Do not allow materials to accumulate on site.

N. Do not burn or bury materials on site. Leave site in clean condition.

3.04 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Partially remove paving, curbs and sidewalks as indicated on Drawings or as directed in the field by the Engineer. Neatly saw cut edges at right angle to surface.

C. Unused existing lines shall be removed when in same trench or within influence of new trench or excavation for new construction.

D. Unused existing drainage structures shall be removed in accordance with the latest revision of the MDOT Standard Specifications for Construction.

E. Where catch basins are removed, the lead shall also be removed.

3.05 DISPOSAL OF UNSALVAGEABLE MATERIAL

A. Do not dispose of material, temporarily or permanently, in any wetland or flood plain.

B. Dispose of all unmarketable timber and other vegetative debris resulting from construction operations.

3.06 ABANDONING SEWER AND WATERMAIN PIPE

A. Unused existing lines not within influence of new construction shall be abandoned in place and the ends shall be bulkheaded in accordance with the latest revision of the MDOT Standard Specifications for Construction.

3.07 TOPSOIL EXCAVATION

A. Excavate topsoil from excavated or regarded areas without mixing with foreign materials for use in finish grading.

B. Do not excavate wet topsoil.

C. Stockpile in approved area to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material until disposal.

D. Do not remove topsoil from site without Owner's permission. Owner shall have first right of refusal for all excess topsoil.

3.08 ITEMS TO BE TURNED OVER TO OWNER

A. All items to be removed shall become the property of Contractor unless requested by the Owner. Contractor shall be responsible for acceptable disposal of such material.

B. Items to be removed, stored, and protected for reinstallation:

1. Valves and/or piping as called out in the plans.

END OF SECTION

SECTION 02222

EXCAVATION

PART 1 GENERAL

1.01 WORK INCLUDED

A. Excavation for building foundations.

B. Excavation for slabs-on-grade paving and curbing.

C. Excavation for site structures.

1.02 FIELD MEASUREMENTS

A. Verify that survey benchmarks and intended elevations for the work are as indicated.

1.03 PROTECTION

A. Protect excavations by shoring, bracing, sheet piling, underpinning or other methods required to prevent cave-in or loose soil from falling into excavation.

B. Underpin adjacent structures which may be damaged by excavation work, including service utilities and pipe chases.

C. Notify the Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.

D. Protect bottom of excavations and soil adjacent to and beneath foundations from frost.

E. Grade excavation top perimeter to prevent surface water run-off into excavation.

F. Protect benchmarks and existing structures, roads, sidewalks, paving and curbs against damage from equipment and vehicular traffic.

G. Excavation should be done as per MI OSHA requirements.

PART 2 PRODUCTS

2.01 MATERIALS

A. Subsoil: Excavated material, graded free of lumps larger than 3 inches, rocks larger than 3 inches, organics and other debris.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify required lines, levels, contours and datum.

B. Maintain benchmarks, monuments at the reference points.

3.02 EXCAVATION

A. Excavate subsoil required to accommodate building foundations, slabs-on-grade, paving and site structures, construction operations and other work.

B. Excavation cut not to interfere with normal 45 degree bearing splay of foundation.

C. Hand trim excavation. Remove loose matter.

D. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd measured by volume.

E. Correct unauthorized excavation at no extra cost to Owner.

F. Before starting excavation, re-establish location and extent of underground utilities in work areas.

G. Notify utility companies having jurisdiction to remove and relocate lines which are in the way of excavation.

H. Maintain, reroute or extend as required, existing utility lines to remain which pass through work area.

I. Protect active utility service lines from areas of excavation. Cap, plug or seal such lines and identify at grade.

J. Accurately locate and record abandoned and active utility lines rerouted or extended, on Project Record Documents.

K. Do additional excavation only by written authorization of the Engineer.

L. Notify the Engineer of unexpected subsurface conditions and discontinue affected work in the area until notified to resume work.

M. When complete, verify soil bearing capacities, depths and dimensions.

N. Stockpile excavated subsoil for re-use where directed. Remove excess or unsuitable excavated subsoil from site.

O. Do not disturb soil within branch spread of existing trees or shrubs that are to remain.

P. Remove surplus excavated and unsuitable materials from site as directed by the Engineer.

3.03 PEAT EXCAVATION

A. Peat excavation shall include excavation of peat, muck, marl and underlying very soft clay. Excavated peat shall be removed from the site and disposed of by the Contractor. Any disposable material to be reused shall only be done by written instructions of the Engineer.

B. All peat material shall be excavated until a depth at which suitable soil is encountered.

C. Peat excavation shall be required in all areas as shown on Drawings or as determined in the field by the Engineer.

D. Provide for visual inspection of bearing surfaces.

END OF SECTION

SECTION 02227

SELECTIVE DEMOLITION

PART 1 GENERAL

1.01 Section Includes:

A. Demolition and removal of selected portions of building or structure.

B. Salvage of existing items to be reused or recycled.

1.02 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner ready for reuse.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

E. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.03 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.04 SUBMITTALS

A. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's building manager's and other tenants' on-site operations are uninterrupted.

2. Interruption of utility services. Indicate how long utility services will be interrupted.

3. Coordination for shutoff, capping, and continuation of utility services.

4. Use of elevator and stairs.

5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

B. Inventory: Submit a list of items that have be removed and salvaged.

1.05 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect/Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: Are not known to be present in buildings and structures. Notify Architect/Engineer any are found before proceeding with selective demolition.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1.06 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.07 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Engage a professional engineer to perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

1. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

2. Perform surveys to determine exact locations of reinforcing in concrete and/or masonry as needed to avoid cutting or damaging reinforcement as noted on structural drawings.

3.02 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Owner will arrange to shut off indicated services/systems when requested by Contractor.

2. Arrange to shut off utilities with utility companies.

3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

4. Disconnect, demolish, and remove fire-suppression systems, plumbing, and HVAC systems, equipment, and components indicated on Drawings to be removed.

a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.

b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.

c. Equipment to Be Removed: Disconnect and cap services and remove equipment.

d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.

e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

3.03 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.

2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.

3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.

4. Cover and protect furniture, furnishings, and equipment that have not been removed.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.04 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.

2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.

3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.

4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.

5. Maintain fire watch during and for at least 24 hours after flame-cutting operations.

6. Maintain adequate ventilation when using cutting torches.

7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.

8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.

9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

10. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Removed and Salvaged Items:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on site designated by Owner.
5. Protect items from damage during transport and storage.

D. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

E. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.05 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated. Review structural drawings to determine if reinforcement can be cut, damaged, or removed.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts. Review structural drawings to determine if reinforcement can be cut, damaged, or removed.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts. Review structural drawings to determine if reinforcement can be cut, damaged, or removed.

3.06 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction and recycle or dispose of them.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

B. Burning: Do not burn demolished materials.

3.07 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.08 SELECTIVE DEMOLITION SCHEDULE

A. Remove: See Drawings.

B. Remove and Salvage: See Drawings.

C. Remove and Reinstall: See Drawings.

D. Existing to Remain: See Drawings.

E. Dismantle: See Drawings.

END OF SECTION

SECTION 02270

SOIL EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Completion and submission of the required Soil Erosion and Sedimentation Control Permit.

B. Performing required site storm water inspections in accordance with permit and Michigan Department of Environment, Great Lakes and Energy (EGLE) rules and regulations.

C. Placement, maintenance, relocation, and removal of temporary erosion control measures.

D. Placement of permanent erosion control measures.

E. Placement of silt fence, culverts, sediment traps, excavated sediment traps, check dams, and other such effective measures deemed necessary to control soil erosion or as may be directed by the Engineer.

1.02 PROTECTION

A. Protect all excavation, backfilling, trenching, fill slopes, drainage structures, pumping station locations, and other work improvements remaining as final work.

1.03 REFERENCES

A. Michigan Soil Erosion and Sedimentation Control Guidebook.

B. Soil Erosion and Sedimentation Control Measures (refer MDOT Standard Plans R-96-C or latest revision thereof).

C. Part 91 of Public Act 451.

D. Latest revision of the MDOT Standard Specifications for Construction.

1.04 REGULATORY REQUIREMENTS

A. The Contractor shall be required to obtain the Soil Erosion and Sedimentation Control (SESC) permit from the Marquette County Conservation District (MCCD).

B. The Contractor shall be required to acquire permit and pay for all costs related to obtaining and maintaining the conditions laid out in the permit.

C. The Owner shall sign the SESC permit prior to submission to the MCCD.

D. The Contractor shall submit a copy of the approved county SESC permit to the Owner and to the Engineer. If the project disturbance area exceeds 5 acres, the Owner will be required to submit a Notice of Coverage (NOC) to EGLE. Contractor will be required to follow all requirements in the SESC permit and the NOC.

E. The Contractor shall be required to perform weekly site storm water inspections of the Contractor's SESC measures and after each rainfall runoff event in accordance with all applicable laws, rules, and regulations. Site storm water Inspections shall be performed by a certified Site Storm Water Operator in the state of Michigan. The Contractor shall provide the Engineer with a copy of the Site Storm Water Operator's Certification prior to beginning Work on the project. The Contractor's Certified Site Storm Water Operator

shall be required to keep a log of inspections on-site for review by regulatory agencies and Engineer as required by all applicable laws, rules, and regulations.

F. The Contractor shall pay for all costs related to maintaining the conditions required by all permits and as directed by the Engineer.

1.05 SUBMITTALS

A. The Contractor shall submit two (2) copies of the approved SESC permit to the Engineer prior to construction for Engineer's approval.

B. The Engineer shall review the Contractor's SESC plan and make any corrections and/or modifications to the SESC plan required by the permits and/or Engineer and return to the Contractor for incorporation into the Work.

C. Submit a minimum of two (2) copies of the SESC plan and Site Storm Water Operator's Certificate to the Engineer at the preconstruction conference.

D. Submittals shall be in accordance with Section 01330.

PART 2 MATERIALS

2.01 TEMPORARY EROSION CONTROL MEASURES

A. Contractor shall use Drawings as a guide for minimum requirements and shall conduct his/her work in conformance with the conditions laid out in the permit.

B. The Contractor shall incorporate into the Work any corrections and/or modifications as directed by the Certified Storm Water Operator, governing agency, or Engineer.

2.02 PERMANENT EROSION CONTROL MEASURES

A. Contractor shall use Drawings as a guide for minimum requirements and shall install and maintain permanent erosion control as per conditions of the permit.

B. The Contractor shall incorporate into the Work any corrections and/or modifications as directed by the Certified Storm Water Operator, governing agency, or Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify site conditions and note irregularities affecting work of this section.

B. The Certified Site Storm Water Operator shall perform required inspections of the Contractor's SESC measures for each work site on the project and maintain a log of inspections on-site and submit inspections if required by governing agencies.

C. The Certified Site Storm Water Operator shall immediately report to the Contractor and Engineer, the results of each inspection where it is determined that the Contractor's SESC measures require modifications or repair.

3.02 PLACEMENT

A. The Contractor shall install SESC measures required by the permits prior to beginning work on the project.

B. Place, maintain, and relocate as necessary temporary soil erosion control measures.

C. Place permanent soil erosion control measures as per conditions laid out in the permit and as directed by the Owner, Engineer, MCCD, and/or EGLE.

D. Upon completion of the work and placement of permanent erosion control measures remove temporary erosion control measures.

END OF SECTION

SECTION 02320

BACKFILL

PART 1 GENERAL

1.01 WORK INCLUDED

A. Building perimeter backfilling.

B. Site filling and backfilling.

C. Fill under building slabs-on-grade, pavements, curbs, sidewalks, retaining walls and sidewalks.

D. Fill for peat excavation areas.

E. Consolidation and compaction.

F. Fill for over-excavation.

G. Compaction requirements 95 percent of 1.02D.

1.02 REFERENCES

A. ANSI/ASTM C136: Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557: Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10 lb (4.54 kg) Rammer and 18-inch (457 mm) Drop.

C. ASTM D 2321: Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-flow Applications.

D. ANSI/ASTM 2922: Density of Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

E. Latest revision of the MDOT Standard Specifications for Construction Section; Definition of Maximum Unit Weight, Michigan Cone.

F. Latest revisions of the MDOT Standard Specifications for Construction Section.

1.03 SUBMITTALS

A. Quality Control Submittals and Test Reports:

1. Sieve Analysis Reports for pipe bedding materials, road sand subbase, and road aggregate base materials shall be submitted in accordance with Section 01330 and 01400.

2. All tests will be done at the Contractor’s expense per Section 01400.

PART 2 PRODUCTS

2.01 FILL MATERIALS

A. Trench Undercut and Backfill: MDOT 25A Course Aggregate.

B. Coarse Stone: MDOT 6A Coarse Aggregate.

C. Granular material used for backfill shall be MDOT Class II material.

D. Granular material used for pipe bedding shall be MDOT Class IIIA material.

E. Sand Embankment: MDOT granular material Class III.

F. Existing excavated material may be used for embankment and trench backfill if approved by the Engineer in the field.

1. If not approved, Contractor shall use granular material in accordance with Section 02315.

G. Pea Gravel - ASTM C-33 Gradation #8 for Coarse Graded Aggregates.

PART 3 EXECUTION

3.01 QUALITY ASSURANCE

A. Prior to placement of any aggregate, Contractor shall supply sieve analysis test results for each aggregate material type to be incorporated into the Work. A minimum of two samples shall be analyzed and test results submitted to the Engineer for verification of conformance to the Specifications.

B. If at any time during the performance of the Work, Contractor changes sources for aggregate materials, the Contractor shall be required to perform two (2) additional sieve analysis test results for each type of aggregate material and shall submit results to the Engineer prior to incorporating aggregate into the Work.

C. The Engineer shall have the discretion to order additional testing of the aggregate materials, if the materials are of inconsistent quality. The costs of all aggregate materials testing shall by borne by the Contractor per Section 01400.

D. Verify pipe is in-place properly bedded and driven home to manufacturer’s mark on pipe prior to backfilling.

E. Verify foundation perimeter drainage installation has been inspected.

F. Verify underground tanks are anchored to their own foundation to avoid flotation after backfilling.

G. Verify conduits and utilities are in place prior to backfilling.

H. Verify areas to be backfilled are free of debris, snow, ice, or water, and ground surfaces are not frozen.

3.02 PREPARATION

A. Compact subgrade to density requirements for subsequent backfill material.

B. Cut out soft areas of subgrade not capable of insitu compaction. Backfill with MDOT Class III fill and compact to density equal to or greater than requirements for subsequent backfill material.

C. Prior to placement of aggregate base course material at gravel or paved areas, compact subsoil to 95 percent of its maximum dry density as determined by MDOT Michigan Cone Test.

3.03 BACKFILLING

A. Backfill areas to contours and elevations. Use unfrozen materials.

B. Use MDOT Class II material for all areas under sidewalks, curbs, parking lots, drives (paved and gravel), proposed building foundations, tanks. All MDOT Class II material shall be imported unless approved by the Engineer.

C. Use MDOT Class III material as embankment up to the depth that either structural fill or subbase begins.

D. Use MDOT Class III material for all peat excavated areas.

E. Use existing excavated material for all areas to be landscaped (seed or sod).

F. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

G. All fill material shall be placed and compacted. Place and compact materials in continuous layers not exceeding 12 inches loose depth in accordance with ASTM 1557 to a minimum of 95% maximum dry weight.

H. Employ a placement method so not to disturb or damage foundation dampproofing, foundation waterproofing, protective cover, and utilities in trenches.

I. Maintain optimum moisture content of backfill materials to attain required compaction density.

J. Backfill against supported foundation walls. Do not backfill against unsupported foundation walls.

K. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.

L. Slope grade away from building as indicated on Drawings, unless noted otherwise.

M. Make grade changes gradual. Blend slopes into level areas.

N. Remove surplus backfill materials from within grading limits and stockpile for later use by the Owner.

O. Install buried thermoplastics pipe in accordance with trenching, bedding, haunching and embedment and backfill guidelines per ASTM D 2321.

P. Materials for trench bedding and pipe embedment shall, at a minimum, be in accordance with ASTM D 2321.

3.04 TOLERANCES

A. Top Surface of Backfilling (Subgrade) Under Paved Areas: Plus or minus 3/4 inch.

B. Top Surface of Backfilling (Subgrade) Under Lawn Areas: Plus or minus 3/4 inch.

3.05 FIELD QUALITY CONTROL

A. Compaction tests will be made by an agent of the Owner.

B. The Contractor shall cooperate with the Owner’s agent in order to obtain appropriate tests as directed by the Engineer.

C. The Contractor shall provide all labor and equipment as necessary to excavate holes for compaction testing if necessary.

D. The Contractor shall schedule his work activities to provide adequate time for the Owner’s agent to perform compaction testing without interference.

E. Compaction testing shall be performed by the nuclear method.

F. Maximum density shall be determined in accordance with the One-Point Michigan Cone Test or the One-Point T-99 Test as described in the MDOT Density Control Handbook.

G. If tests indicate work does not meet specified requirements, remove work, replace, and retest at no cost to Owner.

3.06 PROTECTION OF FINISHED WORK

A. Protect finished work.

B. Recompact fills subject to vehicular traffic.

3.07 SCHEDULE

A. Grading limits as shown on Drawings.

END OF SECTION

SECTION 02324

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Excavate trenches for utilities to locations as shown on the Drawings.

B. Compacted bedding and compacted fill over utilities to subgrade elevations.

C. Compaction requirements as per Section 02320, and as approved by the Engineer.

D. Dewatering system as warranted by the site conditions to perform timely and safe progress of the work.

1.02 REFERENCES

A. ANSI/ASTM C136: Sieve Analysis of Fine and Coarse Aggregates.

B. ANSI/ASTM D1557: Tests for Moisture-Density Relations of Soils and Soil-Aggregate Mixture Using 10 lb (4.54 kg) Rammer and 18-inch (457 mm) Drop.

C. ANSI/ASTM D1556: Test Method for Density of Soil in Place by Sand-Cone Method.

D. ANSI/ASTM D2922: Density of Soil and Soil Aggregate in Place by Nuclear Methods.

E. Latest revision of the MDOT Standard Specifications for Construction.

1.03 FIELD MEASUREMENTS

A. Engineer to verify the survey benchmark and intended elevations for the work are as shown on Drawings.

PART 2 PRODUCTS

2.01 BEDDING AND BACKFILL MATERIALS

A. Materials are specified in Section 02320, Backfilling.

B. Bedding material for storm sewer, sanitary sewer and water main, in general, shall consist of MDOT Class III A Granular material. While some small amounts of clay or silt will be acceptable in the material, it shall be substantially free of rocks, sticks, boulders, rubbish, muck, and other debris which could cause damage to the pipe. Bedding material which contains frozen chunks shall not be used. MDOT 25A Coarse Aggregate Material shall be used in wet conditions, only after prior written approval is obtained from the Engineer.

C. Unless otherwise called for on the Drawings, or when directed by the Engineer material excavated from the trench may be used for backfill, provided that it consists of sand, loam, or other suitable material. MDOT Class II material shall be used as backfill under the street, sidewalk, curb, parking lot and adjacent to building foundations.

D. Unstable materials containing peat or other organics, or materials which contain large amounts of refuse, broken pavement, boulders, roots, stumps, or other debris, shall not be incorporated into the backfill, and shall be disposed of offsite at no extra cost to the Owner.

E. MDOT 25A stone material shall be used for backfilling trench undercuts or for trench stabilization, after obtaining prior written approval of the Engineer.

F. Trench backfill under roadway influence shall be placed, up to the bottom of sand subbase.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify fill materials to be reused is acceptable.

B. Contractor to obtain prior written approval and certification of the borrower source from the Engineer.

3.02 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Maintain and protect existing utilities remaining, which pass through work area.

C. Protect plant life, lawns, and other features remaining as a portion of final landscaping.

D. Protect bench marks, existing structures, sidewalks, paving, and curbs from excavation equipment and vehicular traffic.

E. Protect above and below grade utilities which are to remain.

F. Cut out soft areas of subgrade incapable of in situ compaction. Backfill with MDOT Class II Granular material and compact to density equal to or greater than requirements for subsequent backfill material.

G. Contractor shall be allowed for a trench width at bottom of 36 inches (for all sizes of pipes) and four inches below the underside of the pipe barrel for soils. Contractor shall comply with all rules and regulations and precautions laid out by MI OSHA, and by utility agencies for a safe operation. Any additional excavation outside the limits, and installing bedding and backfill to replace excessive trench excavation shall not be paid for separately, and Contractor to include such costs in other pay items.

H. Contractor shall determine prior to the bid and satisfy himself/herself to the extent of dewatering necessary as based on site conditions and evaluation of soil boring information (see Appendix "A"). Dewatering shall not be a separate pay item and cost of all dewatering under the construction of this project shall be deemed to have been included in other pay items.

I. Contractor shall not be allowed more than 200 linear feet of open trench at one time. Under unusual circumstances, the Engineer may authorize more than 200 linear feet of trench to be open, provided that pedestrian and driveway crossings are maintained at intervals of not more than 200 feet and that not more than one street intersection is closed to traffic.

J. During construction, existing culverts may have to be removed temporarily. Contractor to exercise care in removing and reinstalling the existing culvert at their previous grade and alignment. If existing culvert is damaged during removal and replacement is required, Contractor shall replace with new pipe of the same size and length.

K. All costs to remove, salvage and reuse the existing culverts and installation to the same grade and location and replace in case of damage, shall not be paid separately, but will be included in other pay items in the bid schedule.

L. Any existing culvert which is predetermined to be in poor condition, the Contractor shall bring to the Engineer's attention prior to removal. Engineer shall decide and approve in writing to replace the culvert by a new culvert pipe of the same size and material. Payment for this item shall be paid as special case at the Contract Unit Price in the Bid Schedule.

M. Where MDOT 25A coarse aggregate bedding is used, bedding shall be entirely covered with geotextile in accordance with the latest version of the MDOT Standard Specifications for Construction. Any seams or splices shall have a minimum two (2) foot overlap.

3.03 EXCAVATION

A. Excavate subsoil required for storm sewer, sanitary sewer, water, gas, and electrical conduit piping to municipal utilities.

B. Cut trenches sufficiently wide to enable installation of utilities and allow inspection per trench detail on drawings.

C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.

D. Hand trim excavation. Hand trim for bell and spigot pipe joints. Remove loose matter.

E. Remove lumped subsoil, boulders, and rock.

F. Correct unauthorized excavation at no cost to Owner.

G. Correct areas over-excavated by error.

3.04 BEDDING

A. Support pipe and conduit during placement and compaction of bedding fill.

3.05 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen material.

B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.

C. Granular Fill: Place and compact materials in continuous layers not exceeding 12" loose depth.

D. Maintain optimum moisture content of backfill materials to attain required compaction density.

E. Stockpile surplus backfill materials as directed by the Engineer.

F. Employ a placement method that does not disturb or damage utility conduits in the trench.

3.06 TOLERANCES

A. The upper limits of backfill shall be top of subgrade under roadways (approaches, sidewalks, etc.). In other areas, upper limit shall be bottom of topsoil.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed by the Engineer.

B. Tests and analysis of fill material will be performed in accordance with the Specifications.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest at no cost to Owner, and as approved by the Engineer.

END OF SECTION

SECTION 02635

DRAINAGE STRUCTURE COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Frames and covers for manhole and catch basin structures.

1.02 DESCRIPTION

A. Work includes supplying and installing the specified grate and casting in accordance with the latest revision of the MDOT Standard Specifications for Construction.

B. All manhole openings shall be 24” I.D. unless otherwise shown or approved.

1.03 QUALITY ASSURANCE

A. Contractor responsible for coordinating manhole and catch basin frame and cover size.

1.04 SUBMITTALS

A. Not required for products identical to those specified herein by name of manufacturer and model number.

B. For products other than those specified, submit manufacturer’s standard product literature in accordance with 01330.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. East Jordan Iron Works, Inc. (EJIW)

B. Neenah Foundry

2.02 CATCH BASIN COVERS

A. All catch basins for use with MDOT Concrete Curb and Gutter Details C1, C2, F1, and F2 shall have MDOT Type L covers unless noted otherwise.

B. All catch basins for use with MDOT Concrete Curb and Gutter Detail D shall have MDOT Type C covers unless noted otherwise.

C. All catch basins for use with straight curb and curb and gutter shall have MDOT Type D covers unless noted otherwise.

D. All catch basins for use with MDOT Concrete Curb and Gutter Detail B shall have MDOT Type J covers unless noted otherwise.

E. All catch basins for use with MDOT Concrete Curb and Gutter Details C3, C4, C5, C6, F3, F4, F5, and F6 shall have MDOT Type K covers unless noted otherwise.

F. All catch basins for use with MDOT Concrete Curb Detail E shall have MDOT Type M covers unless noted otherwise.

2.03 STORM SEWER COVERS

A. All storm sewer collection system manholes shall have vented covers unless noted otherwise.

2.04 SANITARY SEWER MANHOLE COVERS

A. All sanitary sewer collection system manholes shall have solid covers with gasket seals unless noted otherwise.

2.05 COVER DESIGNATION.

A. The following table shall be used to reference between the drainage structure covers shown on the plans to the type of grate which shall be supplied by the contractor.

COVER NAME	CATALOG NO.	WEIGHT (LBS.)	COMMENT*
Sanitary Manholes (all)	EJIW Cat. No. 1040 with heavy duty solid cover with gasket seal and closed pick holes	375	24” diameter opening, 7” frame height, 39” flange o.d.
Storm Manhole with Vented Cover	EJIW Cat. No. 1040 with heavy duty vented cover and open pick holes	375	24” diameter opening, 7” frame height, 39” flange o.d.
Storm Manhole with Flat Open Gate for use where specified on Drawings	EJIW Cat. No. 1040 with heavy duty Type M1 Flat Grate	360	24” diameter opening, 7” frame height, 39” flange o.d., 190 Sq. Inch opening
Storm Manhole with Oval Grate for use where specified on Drawings	EJIW Cat. No. 1040 with heavy duty Type N Grate	375	24” diameter opening, 7” frame height, 39” flange o.d., 140 Sq. Inch opening
Storm Manhole with Beehive Grate for use where specified on Drawings	EJIW Cat. No. 1040 with heavy duty Type 02 Grate	330	24” diameter opening, 7” frame height, 39” flange o.d., 185 Sq. Inch opening
MDOT Type C	EJIW Cat. No. 7066 with Type M1 Grate and 7060 T1 Back	505	20 ¼” diameter opening, 9 1/8” frame height, 30 1/16” flange o.d., 195 Sq. Inch opening
MDOT Type D	EJIW Cat. No. 5100 with Type M1 Grate	465	20-1/8” diameter opening, 8” frame height, 36” flange o.d., 175 Sq. Inch opening
MDOT Type J	EJIW Cat. No. 7085 with Type M1 Grate	655	22 1/8” diameter opening, 8 ¾” frame height, 36” flange o.d., 220 Sq. Inch Opening
MDOT Type K	EJIW Cat. No. 7045 with Type M1 Grate and 7050 T1 Back	505	20 ¼” diameter opening, 9 1/8” frame height, 36” flange o.d., 160 Sq. Inch opening
MDOT Type L	EJIW Cat. No. 7050 with Type M1 Grate and 7050 T1 Back	515	20 ¼” diameter opening, 9 1/8” frame height, 36” flange o.d., 160 Sq. Inch opening, front split frame
MDOT Type M	EJIW Cat. No. 7056 with Type M1 Grate	505	20 ¼” diameter opening, 9 1/8” frame height, 36” flange o.d., 160 Sq. Inch opening, back split frame
Water Distribution System Manhole Covers	EJIW Cat. No. 1893 with solid cover, locking, and gasket deal cover.	650	24.5” diameter opening, 7” frame height, 37.5” flange o.d.
**Fixed frame heights shall be as shown unless Self Adjusting Structure Frame are proposed and approved.*			

PART 3 EXECUTION

3.01 CONSTRUCTION METHODS

A. Construction shall be in accordance with the latest revision of the MDOT Standard Specifications for Construction.

END OF SECTION

SECTION 02721

AGGREGATE BASE COURSE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Crushed stone paving course, compacted.

1.02 REFERENCES

A. ASTM C136 - Sieve Analysis of Fine and Coarse Aggregates.

1.03 TESTS

A. Gradation of stone materials will be performed in accordance with ASTM C136.

1.04 SUBMITTALS

A. Quality Control Submittals and Test Reports:

1. Sieve Analysis Reports for pipe bedding materials, road sand, subbase, and road aggregate base materials shall be submitted in accordance with Section 01330 and 01400.

2. All tests will be done at the Contractor's expense per Section 01400.

PART 2 PRODUCTS

2.01 MATERIALS

A. Aggregate Base 22A under Bituminous, 8" CIP.

1. MDOT 22A CIP to 98 percent. Used as a base course under bituminous paved areas.

B. Aggregate Surface Course, 6" CIP.

1. MDOT 23A CIP to 95 percent. Used for shoulders, parking areas and roads that are not paved.

C. Drive Approach 23A, 6" CIP.

1. MDOT 23A CIP to 95 percent. Used for driveways that are not paved.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade is dry and ready to receive work of this Section.

B. Verify gradients and elevations of base are correct.

3.02 PLACING STONE PAVING/AGGREGATE BASE

A. Spread stone material over prepared base to a total compacted thickness as called for on the Drawings.

B. Level surfaces to elevations and gradients indicated.

C. Compact placed stone materials to achieve 95 percent of the maximum unit weight for surface courses and 98 percent of the maximum unit weight for base courses.

D. Add water to assist compaction. With an excess water condition, rework topping and aerate to reduce moisture content.

E. Perform hand tamping in areas inaccessible to compaction equipment.

3.03 QUALITY CONTROL

A. Prior to placement of any aggregate, Contractor shall supply sieve analysis test results for each aggregate material type to be incorporated into the Work. A minimum of two (2) samples shall be analyzed and test results submitted to the Engineer for verification of conformance to the Specifications.

B. If at any time during the performance of the Work, Contractor changes sources for aggregate materials, the Contractor shall be required to perform two (2) additional sieve analysis test results for each type of aggregate material and shall submit results to the Engineer prior to incorporating aggregate into the Work.

C. The Engineer shall have the discretion to order additional testing of the aggregate materials if the materials are of inconsistent quality. The costs of all aggregate materials testing shall by borne by the Contractor per Section 01400.

END OF SECTION

SECTION 02730

SANITARY SEWER, MANHOLES, AND FORCEMAIN

PART 1 GENERAL

1.01 WORK INCLUDED

A. Valves, fittings, and accessories.

B. Sanitary sewers, laterals, and connections to existing sanitary sewers.

C. Manhole structures and connections to existing sanitary sewer manholes.

1.02 REFERENCES

A. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-flow Applications.

B. ASTM C478 – Precast Reinforced Concrete Manhole Sections.

C. ANSI/ASTM D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

D. ASTM D5926-04 – Standard Specification for Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems.

E. ASTM C1173-02 – Standard Specification for Flexible Transition Couplings for Underground Piping Systems.

1.03 SUBMITTALS

A. Submit product data on pipes, valves, fittings, pipe accessories, manholes, and appurtenances.

B. Submit in accordance with Section 01330.

1.04 PROJECT RECORD DOCUMENTS

A. Accurately record location of pipe runs, connections, manholes, cleanouts, and invert elevations.

B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Sanitary Sewer Main: PVC sanitary sewer main pipe shall be SDR 26 per ASTM 3034 for the sizes indicated on the Drawings.

B. Sanitary Sewer Laterals: PVC sanitary sewer lateral pipe and fittings shall be SDR-26 per ASTM D3034 for the sizes indicated on the Drawings.

2.02 JOINTS FOR PVC PIPE

A. Joints for PVC sanitary sewer main, laterals, and fittings shall be by push-on joints.

2.03 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wyes, bends, elbows, reducers, traps, and other configurations required. See Drawings for cleanouts.

B. Valves and miscellaneous accessories: Manufacturer and model shall be as indicated on the Drawings or an approved equal with end design to connect to piping as shown.

2.04 MANHOLES

A. Base, riser section and flat top shall be constructed in accordance with ASTM C478.

B. Joints shall meet ASTM C443.

C. Connections between manhole structure and pipes shall meet ASTM C923.

D. Manhole Steps:

1. Provide plastic coated steel or cast iron steps with 16" spacing. EJIW 8512, M.A. Industries PS-1-PF or Neenah R-1881-J or equal.

2. Top step to be a minimum of 18" below top of casting in order to enable clear access through cover.

E. Frame and Lid:

1. Castings shall be in accordance with Section 02635.

F. All sewer taps shall be constructed for all sizes of pipes as indicated on the Drawings. All sewer taps shall be made in accordance with the latest revision of the MDOT Standard Specifications for Construction.

2.05 FLEXIBLE TRANSITION COUPLINGS

A. When a new sanitary sewer is connected to an existing sanitary sewer main or lateral and a manhole is not utilized at or near the point of connection, the Contractor shall be required to make a water-tight connection by use of a manufactured flexible transition coupling designed for such purpose.

B. Flexible transition couplings shall be in accordance with ASTM D5926-02 and ASTM C1173-02 or the latest revisions thereof.

C. Manufacturers:

1. Fernco, Inc.

2. Approved Equal

2.06 INSULATION

A. Closed cell, DOW Chemical Company Styrofoam HI-40 brand or equal. Sheet size: 4'x8'.

2.07 COATINGS

A. Exposed piping and fittings shall be coated in accordance with the pipe manufacturer’s specifications and instructions.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavation base is ready to receive work, and excavations, dimensions, and elevations are as indicated on Drawings.

3.02 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with material as specified.

B. Remove large stones or other hard matter which could damage drainage pipe or impede consistent backfilling or compaction.

3.03 DEWATERING SYSTEM AND BYPASS PUMPING

A. The Contractor shall determine prior to bid the extent of dewatering required. Contractor should familiarize himself/herself with existing soil conditions and evaluate the extent of dewatering required to lower the ground water table in the area of excavation by pumping in order to provide dry laying conditions for the pipe, and also to prevent cave-ins and unnecessarily large excavations.

B. The Contractor shall have available adequate equipment to perform the work of dewatering necessary for the timely and safe progress of the work.

C. The Contractor shall have available bypass pumping equipment, labor, and materials to perform the work of bypass pumping for the interrupted flow of sewage in the sewer mains during construction of new sewers and coordinate the progress with the Engineer and Owner.

D. Equipment used for dewatering and bypass pumping shall be of a size and type adequate to perform the job and shall be operated in such a manner as to create as little nuisance to the public as possible. In particular on operations which require continuous pumping over prolonged periods of time, contractor should do everything possible to reduce noise from pumps, generators, and other equipment.

E. The Contractor shall monitor his/her dewatering operation at all times to ensure that the method used does not undermine pipe bedding, place nearby utility in jeopardy, allow groundwater to enter sanitary sewer pipe, or cause subsidence or damage to adjacent properties.

F. Contractor shall, on his own accord, conduct field investigations as deemed necessary to satisfy himself/herself so as to the extent of dewatering and bypass pumping required to satisfactorily conduct the work as per Drawings, Specifications and as directed by the Engineer.

3.04 PVC SANITARY SEWER MAIN

A. Install pipe, fittings, and accessories in accordance with the Contract Documents and the manufacturer’s specifications and instruction.

B. Lay pipe to slope gradient noted on Drawings.

C. Covering and backfilling over the pipe shall be done in accordance with the Contract documents.

D. Compaction of each successive lift shall refer to the Specifications for compaction requirements. Do not displace or damage pipe when compacting.

E. Connect to existing sanitary sewers and manholes, including all fittings, as shown on the Drawings and as specified herein.

F. In soil conditions where 6-foot depth of bury cannot be achieved or for reasons of utilities crossings, provide and install insulation. Insulation shall be laid only after obtaining written approval of the Engineer.

G. Contractors shall utilize a pipe laser and target system for the installation of all sanitary sewer main. The pipe laser shall be set up inside the pipe at all times unless otherwise approved by the Engineer. Pipe shall be laid at the grade indicated on the Drawings. Invert elevations at each manhole shall be field verified and where deviations from plan elevations are encountered, Engineer shall be notified immediately.

3.05 MANHOLES

A. Form bottom of excavation clean and smooth to correct elevation.

B. Install sand fill in 12" layers and compact to 95% density per the specifications.

C. Precast reinforced concrete units shall be constructed and installed in accordance with ASTM C478 and the details shown on the Drawings.

D. Establish elevations and pipe inverts for inlets and outlets as indicated on Drawings.

E. Cast lid and frame level in flat top covers and set to height or elevation indicated on the Drawings.

F. Use adjusting rings as required, but no more than 4, to obtain proper rim elevations.

G. Mortar joints of adjusting rings, plaster outside and strike inside clean.

3.06 PVC SANITARY SEWER LATERALS

A. Compatible for direct connection to wye by push-on joint.

B. Lateral shall be constructed from sanitary sewer main to a building sewer at or near the right-of-way line or other point of termination as directed by Engineer.

C. Minimum grade: 1/8" per foot.

3.07 INSPECTION AND ACCEPTANCE TESTING FOR PVC SANITARY SEWER MAIN

A. The Contractor shall perform deflection, air testing, post construction televising and report, and infiltration or exfiltration (if required by Engineer/Owner) for each manhole to manhole run of PVC sewer installed on the project in the presence of the Engineer. If the Contractor performs any of the inspection and acceptance in the absence of the Engineer, the Contractor shall be required to repeat the testing in the presence of the Engineer at no extra cost to the Owner.

B. The Contractor shall supply the qualified personnel and all equipment and materials necessary to perform the testing as described. Inspection and Acceptance Testing shall be considered incidental and shall be included in the Contract Unit Price for sanitary sewer pipe unless specifically listed in the Bid Schedule.

C. The Contractor shall complete inspection and acceptance testing prior to final street and surface restoration but after backfilling and ground water has returned to its normal level (when dewatering systems are used).

D. All sewers where the ground water level is above the top of the sewer by more than 7 feet, shall be subjected to infiltration tests. All sewers, where the ground water level above the top of the sewer is 7 feet or less, shall be subjected to air tests or exfiltration

tests. If an exfiltration test is performed, the maximum exfiltration rate shall be the same as that permitted from infiltration. For the purposes of exfiltration testing, the internal water level shall be equal to the external water level plus 7 feet as measured from the top of the sewer pipe.

E. Within five (5) working days following pipe-laying and backfilling of each manhole to manhole section, the Contractor shall complete all testing. Should the workmanship employed or pipe material selected fail to meet the test requirements, the Contractor shall select a different material or utilize different techniques to achieve the desired results.

F. Where groundwater conditions require dewatering operations in order to construct sewers, the Contractor, may, at his option, perform preliminary air tests after backfilling and while the dewatering equipment is still operating. After dewatering operations have ceased and groundwater has stabilized at its normal level, 7 feet or less above the sewer and if the preliminary air test was satisfactory, the preliminary air test may be accepted as final.

G. Any defects found during the inspection and acceptance testing shall be promptly repaired by the Contractor as no additional cost to the Owner.

H. Deflection testing of PVC sewer pipe:

1. In addition to other acceptance tests, PVC sewer pipe shall be tested for vertical deflection.

2. Deflection tests shall be performed on 100% of the total footage of PVC sewer pipe of eight (8) inches in diameter and larger installed on the project.

3. This testing shall be carried out under the observation of the Engineer using a GO-NO-GO device approved by the Engineer and furnished by the Contractor.

4. The deflection testing shall be performed between thirty (30) days after final backfill of the trench and thirty (30) days prior to final acceptance of the project.

5. The maximum allowable vertical deflection of the circular cross section of the pipe will be limited to five percent (5%) of the actual internal pipe diameter. If the results of the testing show the deflection of any sewer to be in excess of the maximum allowable, then the Contractor shall make repairs by re-excavation and compaction or replacement at no additional expense to the Owner.

I. Air testing of PVC sewer pipe:

1. Air testing shall be performed on 100% of PVC sewer piping installed on the project.

2. The sewer lines shall be tested in increments between manholes. The lines shall be cleaned and plugged at each manhole. All plugs shall be designed to withstand internal testing pressures without external support and shall provide and air-tight seal. One of the plugs shall have an orifice through which air can be introduced into the sewer. An air supply line shall be fitted with suitable control valves and a pressure gauge for continually measuring the air pressure in the sewer.

3. Air control equipment shall include the following as a minimum:

a. Shutoff valve

b. Pressure regulating valve

c. Pressure relief valve

d. Input pressure gauge

e. Continuous monitoring pressure gauge

f. This gauge shall not be less than 3 ½ inches in diameter and have a pressure range from zero (0) to at least 10 PSI with minimum divisions of 0.10 PSI and an accuracy of plus or minus 0.4 PSI.

4. Two (2) separate hoses shall be used for this test. One connects the control panel to the sealed line for introducing the air, and the second is used to constantly monitor the air pressure buildup. This is done to greatly reduce the chance of over-pressurizing the line.

5. Line Pressurization:

a. Low-pressure air shall be slowly introduced into the pipe until the internal air pressure reaches 4.0 PSIG greater than the greatest back pressure caused by groundwater over the top of the sewer pipe.

6. Pressure Stabilization:

a. After the above test pressure is reached, the air supply shall be throttled to maintain the internal pressure for at least two (2) minutes. If necessary, air shall be added to the sewer to maintain a pressure of 3.5 PSIG or greater.

b. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

7. Test Pressure:

a. When temperatures have been equalized and the pressure stabilized, the air supply hose shall be closed so that no more air will enter the sewer.

b. The sewer air pressure shall be noted and timing for the test begun.

c. The test shall not begin if the air pressure is less than 3.5 PSIG, or such other pressure as is necessary to compensate for ground water level.

8. Air Test Timing:

a. A predetermined time for the duration of the test shall be used to determine the line's acceptability.

b. The allowable time shall be calculated from the following equation:

1) T = 0.085*D*K/Q, where

2) T = Shortest time in seconds, for pressure to drop 1 PSIG

3) K = 0.000419 D*L, but not less than 1.0

4) Q = Coefficient = 0.0015 cf/min/sf or internal surface area

5) D = nominal pipe diameter, in inches

6) L = Length of pipe being tested, in feet

c. The following table represents the allowable time required for the air pressure to decrease 1.0 PSIG for the given diameters and lengths of pipe:

ALLOWABLE TIME, T (MINUTES:SECONDS) FOR SEWER TEST LENGTH, L (FEET)				
Pipe Diameter (inches)	***L=100***	***L=200***	***L=300***	***L=400***
8	7:34	7:34	7:36	10:08
10	9:26	9:26	11:52	15:49
12	11:20	11:24	17:05	22:47
15	14:10	17:48	26:42	35:36
18	17:00	25:38	38:27	51:16
21	19:50	34:54	52:21	69:48
24	22:47	45:34	68:22	91:10

J. Post Construction Televising and Report:

1. Per Section 02738.

K. Infiltration Testing:

1. Maximum allowable infiltration testing shall not exceed 100 gallons per inch of diameter per mile of pipe per 24 hours for any individual run between manholes.

2. The following table is a schedule of sanitary sewer infiltration (exfiltration) for the specified pipe diameters:

ALLOWABLE LIMITS BASED ON 100 GALLONS PER INCH OF DIAMETER OF PIPE, PER MILE OF PIPE, PER 24 HOURS	
Pipe Diameter (inches)	***Allowable Limit (gallons/foot/hour)***
8	0.00630
10	0.00790
12	0.00950
15	0.01185
18	0.01420
21	0.01660
24	0.01890

L. If a sewer fails to pass any of the previously described tests, the Contractor shall determine the location of the leaks, excavate, repair them, and retest the sewer. The tests shall be repeated until satisfactory results are obtained.

M. Pressure testing forcemain piping:

1. After the pipeline has been laid, it shall be filled with water, taking care to bleed any trapped air. It shall then be subjected to a hydrostatic pressure test, with a test pressure of 145 psi at the highest elevation of the test section. When, in the opinion of the Engineer, local conditions require that the trenches be backfilled immediately after the pipe has been laid, the pressure test may be made after backfilling has been completed.

2. The test procedure consists of two (2) steps: The initial expansion and the test phases. To compensate for initial expansion of the pipe under test, sufficient make-up water shall be added to the system at hourly intervals for three (3) hours

to return to the test pressure. After the completion of the first phase (4 hours after initially pressurizing the pipe under test), the actual test shall begin.

3. The test phase shall not exceed three (3) hours. After this testing period, a measured amount of make-up water shall be added to return to the test pressure. The amount of make-up water shall not exceed the allowance in the following table. Alternatively, testing for leakage can be done by maintaining the test pressure over a period of four (4) hours, and then dropping the pressure by 10 psi. If the pressure remains steady (within 5% of the target value) for one (1) hour, no leakage in the system is indicated.

ALLOWANCE FOR EXPANSION UNDER TEST PRESSURE *Allowance for Expansion (U.S. Gallons/100 feet of pipe)*			
Nominal Pipe Size (in.)	***1 Hour Test***	***2 Hour Test***	***3 Hour Test***
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
26	5.0	10.0	15
28	5.5	11.1	16.8
30	6.3	12.7	19.2
32	7.0	14.3	21.5
34	8.0	16.2	24.3
36	9.0	18.0	27.0

N. Method of testing and measurement shall be approved by the Engineer.

O. Where structural failures of the pipe have occurred, the broken pipe sections shall be excavated, removed, and reconstructed. The Contractor shall not be permitted to use "Fernco" connectors for repair of mainline pipe sections. The Contractor shall remove the defective section of sewer pipe and relay all sections of sewer pipe from the defective section to the nearest manhole structure otherwise approved by the Engineer/Owner in writing.

3.08 SYSTEM TESTING AND STARTUP

A. In the presence of the Engineer, the Contractor shall fill the lift station and forcemain with clean water, bleeding all air from the forcemain by relief at the air relief manholes and/or cleanouts as required. The Contractor shall start and test the pumps, control system, alarm system, flow meter, gas detection system, and auto dialer. These items are described under other Specification sections. All testing shall be performed in the

presence of the Engineer. Following satisfactory completion of all testing, and with the Engineer's approval, the Contractor shall put the system into operation.

3.09 PROTECTION

A. Protect pipe from damage or displacement until backfilling operation is in progress.

3.10 INSULATION

A. Install insulation a minimum of 2' each way from centerline of pipe. Joints shall be staggered.

B. Insulation shall be installed on compacted fill 6" above top of pipe being insulated.

END OF SECTION

SECTION 02740

ASPHALTIC CONCRETE PAVING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Asphaltic concrete paving.

1.02 REFERENCES

A. The Asphalt Institute - Manual MS-4 - The Asphalt Handbook.

B. The Asphalt Institute - Manual MS-13 - Asphalt Surface Treatments and Asphalt Penetration Macadam.

C. ASTM D946 - Asphalt Cement for Use in Pavement Construction.

D. The latest revision of the MDOT Standard Specifications for Construction.

1.03 QUALITY ASSURANCE

A. Perform work in accordance with the latest revision of the MDOT Standard Specifications for Construction.

B. Mixing Plant: Conform to MDOT Standards.

C. Obtain materials from same source throughout.

D. Do not place asphalt unless base surface temperature is at least 40 degrees F and rising.

PART 2 PRODUCTS

2.01 MATERIALS

A. Asphalt Binder: Penetration Grade 58-28.

B. Aggregate for Level Course: per MDOT- 4EL specifications.

C. Aggregate for Top Course: per MDOT-5EL specifications.

2.02 BITUMINOUS PAVING MIX

A. Use dry materials to avoid foaming. Mix uniformly.

B. Level Course: MDOT-4EL.

C. Top Course: MDOT-5EL.

D. Contractor to submit stability mix designs to the Engineer. The mix designs shall conform to the latest revision of the MDOT Standard Specifications for Construction.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify compacted subgrade and aggregate base is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

C. Contractor shall not commence paving without approval of Engineer and until after approval of subgrade and aggregate base.

3.02 PREPARATION

A. Apply primer to contact edges of pavement cuts.

B. Coat surfaces of manhole frames with MDOT approved release agent to prevent bond with asphalt paving.

C. Edges of existing pavement shall be cut square and even prior to priming.

3.03 PLACING ASPHALT PAVEMENT

A. Place level course within 24 hours of priming base surfaces.

B. Place each course to compacted thickness identified in the Drawings.

C. Compact pavement by rolling. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

D. Develop rolling with consecutive passes to achieve an even and smooth finish, without roller marks.

3.04 TOLERANCES

A. Compacted Scheduled Thickness: Within ¼ inch of design thickness.

B. Surface variations shall be no more than 1/8 inch in 10 feet of the top course.

3.05 FIELD QUALITY CONTROL

A. Field testing and inspection by Engineer/Owner.

B. Upon completion of paving, and in the presence of the Engineer, flood all paved areas with water. Standing water puddles in excess of 10 feet in diameter and/or 1/8" in depth shall be a cause for resurfacing and reshaping that area at no additional cost to the Owner. Upon completion of resurfacing and reshaping operation, the area shall be retested following the procedure noted previously.

3.06 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for such time as no marks will be left.

B. If tests and visual inspections indicate work does not meet specified requirements, remove work and replace at no cost to the Owner.

END OF SECTION

SECTION 02924

SEEDING

PART 1 GENERAL

1.01 WORK INCLUDED

A. Final preparation of topsoil

B. Fertilizing

C. Seeding

D. Mulch

E. Mulch Anchor

F. Compost

G. Hydroseeding

1.02 REFERENCES

A. FS O-F-241C (1): Fertilizers, Mixed, Commercial.

1.03 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.05 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

1.06 TESTS - TOPSOIL

A. Analyze topsoil to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content and pH value.

B. Submit minimum 10 lb. sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.

C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

1.07 MAINTENANCE DATA

A. Submit maintenance data for continuing Owner maintenance.

B. Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.08 DELIVERY, STORAGE AND HANDLING

A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

C. Store and protect products as per manufacturer's instructions.

1.09 COORDINATION

A. Coordinate the work of this section with completion of other phases of work.

1.10 MAINTENANCE SERVICE

A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.

PART 2 PRODUCTS

2.01 SEED MIXTURE

A. Seed shall be MDOT Seed Mixture TDS for non-lawn areas and shall be THM for mowed lawn applications according to the latest revision of the MDOT Standard Specifications for Construction.

B. Furnish the specified seed and mixture composed of certified seed of the purity, germination, and proportions, by weight, listed in the latest revision of the MDOT Standard Specifications for Construction.

C. Furnish seed in durable bags, each marked by the supplier of the blended mix with a tag giving the name, lot number, net weight, of contents, purity and germination.

D. Seed testing shall be conducted according to the Rules for Testing Seeds specified in The Proceedings of the Association of Official Seed Analysts. Deficiencies below the percentage specified for purity and germination shall be evaluated for acceptability by the Engineer.

E. Seed mixture shall be approved by the Engineer prior to placement.

2.02 SOIL MATERIALS

A. Topsoil: Fertile, agricultural soil; typical for locality; capable of sustaining vigorous plant growth; taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of 5.4 to 7.0.

B. Topsoil: Excavated from site and free of weeds.

2.03 MULCH FOR SEED

A. Must consist of any straw or marsh hay in an air-dry condition.

B. Must be clean, undamaged, and rot free.

C. It must be substantially free of weed seed and other objectionable foreign matter.

2.04 FERTILIZER

A. FS O-F-241, Type I, Grade A; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil as indicated in analysis.

B. Fertilizers shall be in accordance with the latest revision of the MDOT Standard Specifications for Construction.

C. Water: Clean, fresh and free of substances or matter which could inhibit vigorous growth of grass.

D. Erosion Fabric: Jute matting, open weave.

E. Stakes: Softwood lumber, chisel pointed.

F. String: Inorganic fiber.

2.05 MULCH BLANKETS AND MULCH NETTING

A. Materials for Mulch Blankets and Mulch Netting shall be in accordance with the latest revision of the MDOT Standard Specifications for Construction Section 917.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify that prepared soil base is ready to receive the work of this Section.

B. Prior to beginning of installation, Contractor to obtain approval from Engineer/Owner.

3.02 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds, and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

3.03 FERTILIZING

A. Apply fertilizer in accordance with the latest revision of the MDOT Standard Specifications for Construction.

B. Apply after smooth raking of topsoil.

C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.

D. Mix thoroughly into upper 2 inches.

E. Lightly water to aid the dissipation of fertilizer.

3.04 PLACING TOPSOIL

A. Cover all areas to be seeded with topsoil. Placement is not required on slopes constructed of topsoil, muck, or peat.

B. Spread topsoil to a minimum depth of 3 inches over area to be seeded. Rake until smooth.

C. Pulverize all large clods and lumps.

D. Rake out rocks more than two inches in diameter, roots, litter, and all foreign matter. Dispose of this material properly and as directed by the Engineer.

E. Place topsoil during dry weather and on dry unfrozen subgrade.

F. Remove vegetative matter and foreign non-organic material while spreading.

G. Grade to eliminate rough, low or soft areas, and to ensure positive drainage.

H. Install edging at periphery of seeded areas in straight lines to consistent depth.

3.05 SEEDING

A. Prepare the seed bed, furnish and sow the specified mixture of seed.

B. Do not seed area in excess of that which can be mulched on same day.

C. Apply seed at a rate of 220 lbs per acre or per manufacturer's specifications and instructions. Manufacturer's seeding rate to be submitted to the Engineer/Owner. Rake in lightly. Seed shall be place according to the manufacturer's instructions.

D. Do not sow immediately following rain, when ground is too dry, or during windy periods.

E. Sow the seed following or in conjunction with fertilizing while the seed bed is in a friable condition.

F. Just before seeding, harrow the topsoil 3 inches deep or more.

1. Harrow with a disk, a spring tooth drag, a spike tooth drag, or other equipment designed to prepare the soil to a friable condition and meeting the approval of the Engineer.

2. Harrow horizontally across the face of the slope.

G. Sow seed before applying mulch.

H. Sow or resow the seed mixture, providing uniform coverage, at the specified rate.

I. Sow with either mechanical drills, hydroseeders, or by broadcasting.

J. Engineer will determine the effectiveness of the seeding equipment.

K. Immediately following seeding, apply mulch at the specified rate. Maintain clear of shrubs and trees.

L. Apply water with a fine spray immediately after each area has been mulched. Saturate to 3 inches.

M. Do not use oat or wheat straw or any other natural mulch material, which is susceptible to weed contamination.

3.06 MULCHING

A. Furnish, spread, and anchor mulch materials.

B. Place mulch loose or open enough to allow some sunlight to penetrate and air to circulate, but thick enough to shade the ground, conserve soil moisture, and prevent or reduce water or wind erosion.

C. Maintain the mulched areas and repair all areas damaged by erosion, traffic, fire or other caused before final or partial acceptance.

D. Replace mulch that is displaced. All costs associated with this repair or replacement work shall be borne by the Contractor.

E. Spread mulch over the surface to a uniform thickness at two (2) tons per acre.

3.07 MULCH ANCHORING

A. Select mulch anchoring materials (tackifier) from the MDOT Qualified Products List.

B. Spray mulch anchoring immediately after the mulch is placed.

C. Do not spray when wind would prevent the proper placement of adhesive.

D. Protect all traffic, signs, structures, and other objects from being marked or disfigured by the tackifier material.

E. Immediately remove overspray.

F. Apply tackifiers at the following minimum rates per acre:

1. Latex-Base. Mix 15 gallons of adhesive, or the manufacturers specified rate whichever is greater, with a minimum of 250 pounds of recycled newsprint and 375 gallons of water.

2. Recycled Newsprint. Mix 750 pounds of recycled newsprint with 1500 gallons of water.

3. Wood Fiber. Mix 750 pounds of wood fiber with 1500 gallons of water.

4. Guar gum. Mix 50 pounds of dry adhesive and a minimum of 250 pounds of recycled newsprint with 1300 gallons of water.

5. Other Tackifiers. Mix 100 pounds of dry adhesive, or the manufacturers specified rate whichever is greater, and a minimum of 250 pounds of recycled newsprint with 1300 gallons of water.

3.08 MULCHING NETTING

A. Place netting over mulch and secure with net anchors, staples, or pins.

B. Spread the net over the mulch so that a worker can walk between adjacent widths of net.

C. Pull the edges of adjacent widths of net together and hold in place with net anchors.

D. Space anchors not more than 2.5 feet apart along the edges, joints, and centerline of the net according to manufacturer’s specifications.

E. Do not place the net in direct contact with the ground.

F. Butt the ends of each width of net together and hold in place by net anchors at each corner and at the center of the net.

G. Do not permit traffic over the net after it is placed, except to repair it.

H. Replace torn or damaged net with undamaged material at no cost to the Owner.

3.09 MULCH BLANKETS

A. Furnish, install, and anchor blankets.

B. Select mulch blankets from the MDOT Qualified Products List.

C. Place mulch blankets within one day after seeding.

D. Overlap blanket side edges two inches.

E. Shingle lap blanket ends 6 inches.

F. Place staples or pegs along all joint edges and along blanket centerlines at a maximum spacing of two feet.

G. In waterways shingle lap blankets with an overlap of 12 inches on the downslope edge.

H. Place blankets on backslopes at right angles to the roadbed.

I. On foreslopes lay the first strip adjacent to the road parallel with the road, with the remainder of the strips placed either parallel or at right angles to the road.

J. When blankets are installed from the top of the slope, do not allow them to free fall down the slope.

K. Place and anchor blankets according to the manufacturer's specifications.

3.10 HYDROSEEDING

A. Apply seeded slurry at a rate of 100 lbs per acre (6 lbs per 1000 sq ft) with a hydraulic seeder. Do not hydro-seed area in excess of that which can be mulched on same day.

B. A tactifier shall be used when hydro-seeding method is used.

C. Immediately following seeding, apply mulch to a thickness of 1/8 inch. Maintain clear of shrubs and trees.

D. Empty the hydroseeders tank within one hour of adding the seed and fertilizer.

E. Dispose of seed that remains mixed with the water for longer than one hour.

F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.11 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 18 inches. Space stakes at 60 inches.

B. Cover seeded slopes where grade is greater than 4 inches per foot with erosion fabric. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Provide 12 inch overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36-inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.12 MAINTENANCE

A. Owner shall be responsible for maintenance.

END OF SECTION

SECTION 03050

BASIC CONCRETE MATERIALS

PART 1 GENERAL

1.01 WORK INCLUDES

A. Material and mix requirements for cast-in-place concrete.

1.02 SUBMITTALS

A. Product Data for cement, fly ash, aggregate, admixtures, and water to include the following:

1. Cement and fly ash (if used), indicate sources of materials; include certification(s) of compliance with specified requirements.

2. Coarse and fine aggregates; include sources of materials and test data demonstrating compliance with specified gradation and quality requirements.

3. Admixtures; include manufacturers and certification(s) of compliance with specified requirements.

4. Indicate source(s) and chemical test results of water source(s) for use in all concreting operations.

5. Mix Design Data - Include mix proportions and complete test results demonstrating compliance with specified requirements. Include mix design provisions for pumping concrete if applicable to proposed means and methods for construction.

B. Statement of Qualifications for Mix Designer and Batch Plant.

C. Manufacturers' Certificates of Compliance for the following:

1. Portland Cement

2. Fly Ash

3. Coarse Aggregate

4. Fine Aggregate

5. Admixtures

1.03 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. ACI 117 – Specifications for Tolerances for Concrete Construction and Materials (not referenced).

b. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.

c. ACI 301 – Specifications for Structural Concrete.

d. ACI 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete (not referenced).

e. ACI 304.2R – Placing Concrete by Pumping Methods (not referenced)

f. ACI 311.5R – Batch Plant Inspection and Field Testing of Ready-Mixed Concrete (not referenced).

g. ACI 318/318R – Building Code Requirements for Structural Concrete and Commentary (not referenced).

2. ASTM International (ASTM):

a. ASTM C33 – Standard Specification for Concrete Aggregates.

b. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens (not referenced).

c. ASTM C88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate (not referenced).

d. ASTM C94 – Standard Specifications for Ready-Mixed Concrete.

e. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete (not referenced).

f. ASTM C150 – Standard Specifications for Portland Cement.

g. ASTM C157 – Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete (not referenced).

h. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory (not referenced).

i. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method (not referenced).

j. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.

k. ASTM C311 – Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete (not referenced).

l. ASTM C452 – Standard Test Method for Potential Expansion of Portland-Cement Mortars Exposed to Sulfate (not referenced).

m. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.

n. ASTM C595 – Standard Specification for Blended Hydraulic Cements (not referenced).

o. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

p. ASTM C1012 – Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution (not referenced).

q. ASTM C1018 – Standard Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading) (not referenced).

r. ASTM C1218 – Standard Test Method for Water-Soluble Chloride in Mortar and Concrete (not referenced).

s. ASTM C1240 – Standard Specification for Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout (not referenced).

t. ASTM D4791 – Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate (not referenced).

B. Where these Specifications differ from the requirements of ACI and/or ASTM, the more stringent requirements shall apply.

1.04 DEFINITIONS

A. Design Strength – Required minimum compressive strength of concrete at respective age, as specified in this Section.

B. Cementitious Materials – Portland cement and fly ash.

1.05 QUALIFICATIONS

A. Mix designer shall be a licensed professional ENGINEER registered in the State of Wisconsin or a Wisconsin Department of Transportation approved concrete mix designer, with a minimum of 5 years of experience in the design of concrete mixes.

B. Batch plant shall be currently certified by the National Ready Mixed Concrete Association.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Cement:

1. ASTM C150, Portland Type II, Type I/II, or approved equivalent.
2. Gray color.
3. Meet the optional chemical requirements for low-alkali cement specified in Table 2 of ASTM C150.
4. Meet the optional physical requirements for false-set limitation specified in Table 4 of ASTM C150.
5. Meet the optional physical requirements for heat of hydration specified in Table 4 of ASTM C150.
6. Furnish from one source.

B. Fly Ash:

1. Class F, meeting applicable requirements of ASTM C618.
2. Loss on ignition: Maximum 3 percent.

C. Aggregates:

1. Fine and coarse aggregates shall conform to applicable requirements of ASTM C33 as modified by these Specifications.
2. Fine and coarse aggregates shall not be potentially reactive as determined in accordance with the provisions of ASTM C33 Appendix X1.
3. Fine and coarse aggregates shall not be of a carbonate-based rock, unless its suitability and durability is proven by tests and approved by ENGINEER.
4. Fine aggregate shall be composed of natural sands.
5. Coarse aggregates shall be composed of natural gravel, crushed gravel, crushed stone, or combinations thereof.
6. Coarse aggregates shall contain no more than 15 percent flat or elongated particles, with maximum-to-minimum dimensions of 5 to 1.
7. Limit deleterious substances in coarse aggregate in accordance with the requirements for Class Designation 3S in Table 3 of ASTM C33.
8. Coarse aggregate gradations shall conform to the following requirements:

TABLE 1

Concrete Class	**ASTM C33 Size No.**	**Nominal Maximum Aggregate Size (inches)**
A	57	1½
B	67	¾
E	3/8	

D. Admixtures:

1. Furnish each admixture from a single manufacturer.
2. Air-Entraining Admixture:
   a. ASTM C260.
   b. Products:
      1) MB-AE 90, Master Builders, Inc., Cleveland, OH.
      2) Daravair 1000, W.R. Grace & Co., Cambridge, MA.
      3) ENGINEER approved equal.
3. Water-Reducing Admixture:
   a. ASTM C494, Type A or Type D.
   b. Products:
      1) Pozzolith or Polyheed, Master Builders, Inc., Cleveland, OH.
      2) WRDA or HYCOL, W.R. Grace & Co., Cambridge, MA.
      3) Eucon WR-91, Euclid Chemical Co., Cleveland, OH.
      4) ENGINEER approved equal.

4. High Range Water Reducing Admixture (Superplasticizer):
    a. ASTM C494, Type F or Type G.
    b. Products:
        1) Rheobuild or Glenium, Master Builders, Inc., Cleveland, OH.
        2) Daracem, W.R. Grace & Co., Cambridge, MA.
        3) Eucon 537, Euclid Chemical Co., Cleveland, OH.
5. Crystalline-Based Permeability Reducing Admixture
    a. ASTM C494, Type S
    b. Products:
        1) Sika WT-215P, Sika, Lyndhurst, NJ.
        2) Xypex Admix C-1000/C-1000NF, Xypex, Richmond, BC, Canada.
        3) Engineer approved equal.

E. Water:
1. Conforming to applicable provisions of ASTM C94.

2.02 CONCRETE MIX PROPORTIONS

A. Provide the following classes of conventional concrete for use in the Work:
1. Type A – For use in reinforced footings, pavements, and slabs on grade:
    a. Minimum Compressive Strength: 4,000 psi at 28 days.
    b. Slump Range at Placement: 3 to 5 inches.
    c. Maximum Water-Cementitious Material Ratio: 0.42.
    d. Air Content Range: 5 to 8 percent.

B. All concrete exposed to freeze/thaw shall be air-entrained. Air content at the point of placement shall conform to the requirements of ACI 301.

C. Fly ash may constitute up to 20 percent by weight of the total cementitious content.

D. Use set-retarding admixtures during hot weather only when approved by Engineer.

E. Slump may be increased to a maximum of 7 inches when chemical admixtures are used, provided that the admixture-treated concrete has the same or lower water-cementitious material ratio and does not exhibit segregation potential or excessive bleeding.

2.03 CONCRETE TEMPERATURE

A. Batch concrete as necessary to achieve placement temperatures between 50°F and 80°F.

B. Use materials and/or procedures necessary to achieve required placement temperatures, including, but not limited to, the following:
1. Replace all or a part of the mixing water with chilled water.
2. Replace all or a part of the mixing water with ice.
3. Introduce liquid nitrogen into the concrete as it is batched.

2.04 BATCHING, MIXING AND TRANSPORTING

A. Batch, mix and deliver to placement site in accordance with ASTM C94.

PART 3 EXECUTION

3.01 MIX DESIGN

A. Develop mix design for each class of conventional concrete required for the Work.

B. Conform to ACI 211.1 and ACI 301.

C. Supporting test data and documentation must represent the actual mix proportions proposed, including all admixtures.

END OF SECTION

SECTION 03110

CONCRETE FORMING

PART 1 GENERAL

1.01 WORK INCLUDES

A. Design, fabrication, erection, and removal of formwork and accessories for cast-in-place concrete.

1.02 SUBMITTALS

A. Manufacturer's Product Data for form ties, spreaders, inserts, other formwork accessories, and form release agent.

1.03 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. American Concrete Institute (ACI):

a. ACI 301 – Specifications for Structural Concrete.

b. ACI 318/318R – Building Code Requirements for Structural Concrete and Commentary.

c. ACI 347R – Recommended Practice for Concrete Formwork.

2. U.S. Product Standard PS-1: Construction and Industrial Plywood.

1.04 DEFINITIONS

A. Design Strength – As defined in Section 03050: Basic Concrete Materials.

1.05 DESIGN REQUIREMENTS

A. Conform to the requirements of ACI 301 and the recommendations of ACI 347 to provide concrete finishes and tolerances specified in Section 03300: Cast-In-Place Concrete.

B. Design forms for full hydrostatic pressure when high range water reducer is used in concrete mix.

C. Make joints in forms watertight.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Plywood – Solid one side grade; sound, undamaged sheets with straight edges.

B. Glass Fiber Fabric Reinforced Plastic Forms – Matched, tight fitting, stiffened to withstand the pressure resulting from placement and vibration of concrete without deflection detrimental to structural tolerances and appearance of finished concrete surface.

C. Lumber – Fir species; No. 2 grade or better; with grade stamp, clearly visible.

D. Steel – Minimum 16 gage sheet, well matched, tight fitting, undamaged, stiffened to withstand the pressure resulting from placement and vibration of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

2.02 FORMWORK ACCESSORIES

A. Form Ties:

1. Removable metal or fixed cone type; ¾- or 1-inch break back dimension; free of defects that will leave holes larger than 1-inch-diameter in concrete surface.

2. Include a swagged or integral metal washer or a neoprene washer in the center of the tie to break surface continuity and minimize water seepage. Minimum size of washer shall be 1/16-inch-thick by 15/16-inch outside diameter.

3. Wire form ties shall not be used.

B. Form Release Agent: Colorless material that will not stain concrete, absorb moisture, or impair natural bonding or color characteristics of concrete.

C. Fillets for Chamfered Corners and All Exposed Edges: Wood strips or rigid plastic; 1-1/2 inches by 1-1/2 inches, unless otherwise shown on the Drawings.

D. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required; of strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify lines, levels, and measurements before proceeding with formwork.

3.02 PREPARATION

A. Hand-trim sides and bottoms of earth forms; remove loose dirt prior to placing concrete.

B. Minimize form joints. Symmetrically align joints and make watertight to prevent leakage of mortar.

C. Tape, gasket, plug, or caulk joints, gaps, and apertures in forms so joints will be watertight and resist concrete pressure without bulging.

D. Arrange and assemble formwork to permit stripping so that concrete is not damaged during form removal.

E. Arrange forms to allow stripping without removal of principal shores, where required to remain in place.

3.03 ERECTION

A. Provide bracing to ensure stability of formwork. Strengthen formwork liable to be overstressed by construction loads.

B. Provide temporary ports in formwork to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain. Close ports with tight fitting panels, flush with inside face of forms, neatly fitted so that joints will not be apparent in exposed concrete surfaces.

C. Provide chamfer strips on all external corners.

D. Construct formwork to maintain tolerances in accordance with Section 03300: Cast-In-Place Concrete.

3.04 CLEANING

A. Thoroughly clean form surfaces to remove foreign matter as erection proceeds, and before application of form release agent.

B. Ensure that water and debris drain to exterior through cleanout ports.

C. During cold weather, remove ice and snow from forms. Do not use de-icing salts. Do not use water to clean out completed forms unless formwork and construction proceed within heated enclosure. Use compressed air to remove foreign matter.

3.05 APPLICATION OF FORM RELEASE AGENT

A. Apply form release agent in accordance with manufacturer's instructions. Apply prior to placing reinforcing steel, anchoring devices, and embedded items.

B. Do not apply form release agent where concrete surfaces are scheduled to receive special finishes that may be affected by the agent.

C. Where wood forms are used and form release agent is not used, soak contact surfaces with clean water to prevent absorption of water from the concrete. Keep surfaces wet prior to placing concrete.

D. Place concrete within 14 days after form release agent is applied to form. If concrete is not placed within 14 days, remove forms and reapply form release agent.

3.06 INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Provide formed openings where required for work embedded in or passing through concrete.

B. Coordinate work of other sections in forming and setting openings, slots, recesses, chases, sleeves, bolts, anchors, and other inserts or embedded items.

C. Install accessories in accordance with manufacturer's instructions, level and plumb. Brace and anchor accessories so they will not move during concrete placement.

3.07 FORM REMOVAL

A. Notify Engineer prior to removing formwork.

B. Do not remove forms until concrete has sufficient strength to support its own weight, and construction and design loads that may be imposed upon it. As a minimum, forms shall remain in place for 36 hours after completion of respective concrete placement.

C. Load supporting forms shall remain in place until concrete has attained at least 75 percent of the specified design strength as determined by test cylinders.

D. Do not damage concrete surfaces during form removal.

E. Finish all concrete surfaces prior to applying curing compound in accordance with the requirements of Section 03300: Cast-In-Place Concrete.

END OF SECTION

SECTION 03150

CONCRETE ACCESSORIES

PART 1 GENERAL

1.01 WORK INCLUDES

A. The Work described in this specification includes the following general items of Work:

1. Construction, expansion, and contraction joints in concrete.
2. Tooling or chamfering edges of concrete.

1.02 SUBMITTALS

A. Joint Filler Materials:

1. Manufacturer's Product Data and installation instructions.
2. 12-inch-long sample of each joint filler material to be used in construction of the Work.

B. Concrete Joints:

1. Layout and location drawing for each type of concrete joint.

1.03 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):

a. ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

b. ASTM D1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

PART 2 PRODUCTS

2.01 JOINT FILLER MATERIAL

A. Conforming to ASTM D1752; pre-molded sponge rubber fully compressible with a minimum recovery rate of 95 percent.

2.02 PLAIN DOWELS

A. Conforming to Section 03200: Concrete Reinforcement.

2.03 PVC WATERSTOP

A. Fabricated from a compound of which the basic resin shall be prime virgin polyvinyl chloride (PVC). Compound shall not contain scrapped material, reclaimed material, or pigment.

B. Conform to performance requirements of CRD-C572.

C. Type – Center bulb with parallel ribs or protrusions on each side of strip center. Constant thickness from bulb edge to outside stop edge. Corrugated- or tapered-type waterstops will not be accepted.

D. Specific Gravity – Not more than 1.4.

E. Shore Durometer Type A Hardness – Not less than 60.

F. PVC waterstops shall be designated as follows: Center bulb waterstop shall be Greenstreak 705 or approved equal. Minimum 6-inches wide, 3/8-inch thick, with ¼" I.C. and 11/16" O.D. center bulb.

2.04 HYDROPHILIC WATERSTOP

A. Hydrophilic waterstops are flexible, rubber-based joint sealant that swells upon contact with water.

B. Minimum ¼-inch wide by 3/8-inch thick.

C. Products:

1. Adeka Ultra Seal MC-2010MN, OCM, Inc., Vernon Hills, IL, with 3M 2141 adhesive and P-201 sealant.

2. Hydrotite CJ-1020-2K Greenstreak Plastic Products, St. Louis, MO, with Leakmaster LV-1 adhesive and sealant.

PART 3 EXECUTION

3.01 CONSTRUCTION JOINT (CJ)

A. Locate construction joints at the locations shown on the Drawings and as otherwise determined by CONTRACTOR and approved by ENGINEER to facilitate construction of the Work. Relocation, addition, or elimination of any construction joint shall be subject to written approval of ENGINEER.

B. Bond is required at construction joints regardless of whether or not reinforcing steel is continuous across the joint.

C. Continue reinforcing steel across construction joints, unless otherwise shown on the Drawings.

D. Surface preparation:

1. Remove laitance and spillage from reinforcing steel and plain dowels.

2. Thoroughly clean surface to remove loose or defective concrete, coatings, sand, curing compound, and other foreign material.

3. Roughen surface to minimum of ¼-inch amplitude:

a. Sandblast if concrete is fully cured.

b. Water blast if concrete is partially cured.

3.02 CONTRACTION JOINT (CTJ)

A. Locate contraction joints at the locations shown on the Drawings or as otherwise required by ENGINEER.

B. Construct so that there is no bond between abutting concrete surfaces.

C. Do not continue reinforcing steel across joint. Place plain dowels if shown on the Drawings.

D. Place concrete on one side of the joint and allow to set before abutting concrete is placed.

E. Clean abutting concrete surface of laitance, dirt and debris.

F. Coat abutting surface with curing compound. Curing compound shall conform to requirements of Section 03 30 00: Cast-In-Place Concrete. Do not coat waterstop with curing compound.

G. Place abutting concrete.

3.03 EXPANSION JOINTS (EJ)

A. Locate expansion joints at the locations shown on the Drawings or as otherwise required by ENGINEER.

B. Construct so that there is no bond between abutting concrete surfaces.

C. Do not continue reinforcing steel across joint. Place plain dowels if shown on the Drawings.

D. Place concrete on one side of the joint and allow to set before abutting concrete is placed.

E. Clean abutting concrete surface of laitance, dirt and debris.

F. Place joint filler material in accordance with manufacturer's instructions.

G. Place abutting concrete.

3.04 PVC WATERSTOPS

A. Installed to form a continuous watertight diaphragm in the joint unless otherwise shown.

B. Installed PVC waterstop with one-half of the width of the waterstop embedded in the concrete on each side of the joint.

C. Provide a minimum of 2 ½ inches of concrete cover over hydrophilic waterstop. When structure has 2 layers of reinforcing steel, locate centered between layers of steel or as otherwise shown on the Drawings.

D. Secure waterstop in correct position. Tie PVC waterstop to reinforcing steel using grommets, "hog rings," or tie wire at maximum spacing of 12 inches.

E. Do not displace waterstop during placement of concrete.

F. Ensure that concrete around waterstop is properly consolidated to ensure complete embedment of the waterstop in the concrete.

G. Splice in accordance with manufacturer's recommendations.

H. Only straight butt splices using heat welding shall be permitted in the field for PVC waterstop. All intersections, transitions, and changes of direction shall be factory fabricated.

3.05 HYDROPHYLIC WATERSTOP

A. Surface of the concrete bedrock must be clean, dry and free from any loose debris.

B. Apply small bead of P-201 approximately ¼" x 3/8".

C. Firmly press MC-2010MN into the P-201 while it is still in the paste state.

D. Smooth excess P-201 against side of MC-2010MN.

E. Allow curing time (estimate 1-2 days) before placing concrete.

F. Place a nail or screw every 12-14 inches if concrete must be placed immediately.

G. Place concrete without displacing or disturbing the position of the waterstop.

H. Use enough P-201 to fill any void between MC-2010MN and the concrete surface.

3.06 TOOLED EDGES

A. Tool or chamfer edges of concrete as shown on the Drawings or required by ENGINEER.

B. Where shown on the Drawings, outside edges of concrete shall be neatly finished with an edging tool. The radius of the tooled edges shall not be greater than ¼-inch

END OF SECTION

SECTION 03200

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Requirements:

1. Section 03110 - Concrete Forming and Accessories: Form materials, waterstops, and accessories required to form cast-in-place concrete.
2. Section 03300 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs on grade, and other concrete components associated with building.

1.02 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. ASTM International:

1. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

C. Concrete Reinforcing Steel Institute:

1. CRSI 10-MSP - Manual of Standard Practice.
2. CRSI 10-PLACE - Placing Reinforcing Bars.

1.03 COORDINATION

A. Coordinate Work of this Section with placement of formwork, formed openings, and other Work.

1.04 SUBMITTALS

A. Section 01330 - Submittal Procedures: Requirements for submittals.

B. Shop Drawings:

1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel and welded wire fabric.
2. Indicate bending and cutting schedules.
3. Indicate supporting and spacing devices.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Submit certified copies of mill test report of reinforcement materials analysis.

E. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.05 QUALITY ASSURANCE

A. Perform Work according to ACI 301 and ACI 318.

B. Prepare Shop Drawings according to ACI SP-66.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.07 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

PART 2 PRODUCTS

2.01 REINFORCEMENT

A. Reinforcing Steel:

1. Comply with ASTM A615.
2. Yield Strength: 60 ksi.
3. Billet Bars: Deformed.
4. Finish: Uncoated, except where indicated on plans.

B. Welded Deformed Wire Fabric:

1. Comply with ASTM A1064.

2. Configuration: Flat sheets or Coiled rolls.

3. Finish: Uncoated.

C. Reinforcing Dowel Epoxy Bonding Adhesive:

1. Two component, solvent -free, moisture-insensitive, high strength epoxy adhesive

2. Product: Hilti HIT – HY 200-A or approved equal.

2.02 FABRICATION

A. Fabricate concrete reinforcement according to CRSI 10-MSP and ACI 318.

B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks as indicated on Drawings.

C. Form reinforcement bends with minimum diameters according to ACI 318.

D. Splicing:

1. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.

2.03 ACCESSORY MATERIALS

A. Tie Wire:

1. Minimum 16 gage, annealed type.

B. Chairs, Bolsters, Bar Supports, and Spacers:

1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.

PART 3 EXECUTION

3.01 INSTALLATION

A. Place, support, and secure reinforcement against displacement.

B. Do not deviate from required position beyond specified tolerance.

C. Accommodate placement of formed openings.

D. Spacing:

1. Space reinforcement bars with minimum clear spacing according to ACI 318.

2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

E. Maintain minimum concrete cover around reinforcement according to ACI 318 as follows:

1. Footings and Concrete Formed against Earth: 3 inches.

2. Concrete Exposed to Earth or Weather:

a. No. 6 Bars and Larger: 2 inches.

b. No. 5 Bars and Smaller: 1-1/2 inches.

F. Splice reinforcing where indicated on Drawings.

3.02 TOLERANCES

A. Install reinforcement within following tolerances for flexural members, walls, and compression members:

1. Reinforcement Depth Greater Than 8 Inches:

a. Depth Tolerance: Plus or Minus 3/8 inch.

b. Concrete Cover Tolerance: Minus 3/8 inch.

2. Reinforcement Depth Less Than or Equal to 8 Inches:

a. Depth Tolerance: Plus or Minus 1/2 inch.

b. Concrete Cover Tolerance: Minus 1/2 inch.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection according to ACI 318 and State Building Code.

B. Provide unrestricted access to Work and cooperate with appointed inspection and testing firm.

C. Reinforcement Inspection:

1. Placement Acceptance: Inspect specified and ACI 318 material requirements and specified placement tolerances.

2. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SYSTEM DESCRIPTION

A. Tolerances:

1. Conform to ACI 117.
2. Concrete slabs shall be within 3/16 in. and ½ in. of 10 ft straightedge for concrete tankage in each direction. Deviations from elevation indicated shall not exceed ¾ in.
3. Pitch slab as shown on Drawings. Minimum thickness of slabs shall be as dimensioned on Drawings. Pitch bottom of slab to match top slope of slab to maintain thickness or depth noted. As an alternate, bottom of slabs may be poured level provided that minimum thickness or depth is maintained.

1.02 SUBMITTALS

A. Shop Drawings:

1. Construction Joints: Sequence of placing concrete and location and details of joints, openings, and embedded items not shown on Drawings. Coordinate sequence of placement and joint location with reinforcement Shop Drawings.
2. Control Joints in Slabs on Grade: Location and details of joints.
3. Verification of Mix Design:
   a. Proposed mix design for each class of concrete to be used as specified using designations indicated. Provide dry weight of cement, saturated surface dry weight of coarse and fine aggregates, brand name and quantity of admixtures when applicable, fly ash or Ground Granulated Blast Furnace slag (GGBF slag) when applicable or in combination and gallons of water required for 1 cu yd of concrete.
   b. Test data supporting proportions of design mixes (excluding Class AA) based on laboratory trial batches in accordance with ACI 318, Chapter 5.
   c. As alternative to test data based on laboratory trial batches, test data supporting proportions of design mixes based on past field experience in accordance with ACI 318, Chapter 5 may be submitted. If this data, in Engineer's opinion, is not in accordance with ACI 318, Engineer will require submittal of test data based on trial batches.
   d. Submit with admixture product data and miscellaneous submittals required herein.
   e. Mix design shall be approved by Engineer before concrete is delivered to site.

B. Product Data:

1. Waterstop: Splicing details and manufacture's literature.

2. Curing Compound: Proposed rate of coverage and manufactures literature indicating conformance with these Specifications.
3. Concrete Admixtures:
    a. Manufacture's literature.
    b. Submit with mix design.
4. High Range Water Reducers:
    a. Name of product and manufacture's literature.
    b. Intended use area.
    c. Submit with mix design.

C. Test Results:
1. Concrete test results.
2. With each load of concrete delivered, provide duplicate delivery tickets, one for Contractor and one for Engineer, with following information.
    a. Date and serial number of ticket.
    b. Name of ready mixed concrete plant, operator and job location.
    c. Type of cement, admixtures, if any, and brand name.
    d. Cementitious content, in bags/cu yd of concrete, and mix design.
    e. Truck number, time loaded, and name of dispatcher.
    f. Amount of concrete in load, cu yds, delivered.
    g. Maximum size aggregate.
    h. Gallons of water added at job, if any, and slump of concrete after water was added.
    i. Temperature of concrete at delivery.
    j. Time unloaded.

D. Miscellaneous Submittals:
1. NRMCA certification of certificate stating plant and equipment complies with NRMCA requirements specified herein.
2. Statement by ready mix supplier giving source and material certificates of cement and fine and coarse aggregates, including sieve analysis, that will be used in manufacture of each class of concrete. Make no changes in sources of materials.
3. Fly Ash: Source and test reports showing fly ash in compliance with these specifications. Reports shall be for actual fly ash to be used in Work.
4. GGBF Slag: Source and test reports showing slag in compliance with these specifications. Reports shall be for actual GGBF slag to be used in work.
5. Method of pumping concrete.
6. Submit with mix design.

E. Submit in accordance with Section 01330.

1.03 QUALITY ASSURANCE

A. Plant Certification: Plant or concrete supplier shall comply with requirements of National Ready Mixed Concrete Association (NRMCA) certification plan as regards material storage and handling, batching equipment, central mixer, truck mixers with counters, agitators, non-agitating units, and ticketing system.

B. Concrete testing: Testing will be provided by Contractor in accordance with Section 01400 and this section.

1. Tests will be conducted on sample material in accordance with applicable ASTM methods listed below:

a. Slump: ASTM C143.

b. Air-Entrainment: ASTM C231.

c. Compressive Strength Test: ASTM C31 (making and curing cylinders) and ASTM C39 (testing).

1.04 PROJECT/SITE CONDITIONS

A. Hot Weather:

1. Comply with ACI 305.1.

2. Concrete temperature shall not exceed 90ºF at placement.

3. At air temperatures of 80ºF, water reducing, set retarding admixtures shall be used in accordance with manufacturer's recommendations.

4. When concrete temperatures exceed 80ºF, water reducing, set retarding admixtures shall be used in accordance with manufacturer's recommendations.

5. Rate of evaporation from concrete surface shall not exceed 0.2 lb/ft²/h based on ACI 305R Table 2.1.5 and Figure 2.1.5. Use fog-spray or evaporation retardant to maintain evaporation at 0.2 lb/ft²/h or less.

B. Cold Weather:

1. Comply with ACI 306.1.

2. Temperature of reinforcement, forms, fillers, and other materials in contact with concrete at time of placement shall not be less than 35ºF.

3. Maintain air and forms in contact with concrete sections having minimum dimension less than 12 in. at temperature above 50ºF for at least first 3 days and at temperature above 32ºF for remainder of specified curing period.

4. Maintain air and forms in contact with concrete in more massive sections at temperature above 40ºF for at least first 3 days and at temperature above 32ºF for remainder if specified curing period.

PART 2 PRODUCTS

2.01 MATERIALS

A. Portland Cement:

1. ASTM C150.
2. Type I or II except tricalcium aluminate (C_3A) content of Type I shall not exceed 8%. If this type of Type I not available, Type I with C_3A content less than 12% shall be used in combination with fly ash or GGBF slag.

B. Fly Ash:

1. ASTM C618, Class C or F including requirements of Table 1A.
2. Supplemental Requirements:
   a. Loss on Ignition (maximum): 3%.
   b. Fineness (maximum retained on No. 325 sieve): 25%.

C. Ground Granulated Blast-Furnace Slag:

1. ASTM C989, modified as follows.
   a. Slag activity classification: Grade 100 or 120.

D. Ground Granulated Blast-Furnace Slag:

1. ASTM C989, modified as follows.
   a. Fine Aggregate: Crushed gravel, crushed stone or gravel uniformly graded (8% to 18% on any sieve).
   b. Coarse Aggregate: Crushed gravel, crushed stone or gravel uniformly graded (8% to 18% on any sieve).

E. Admixtures for Concrete:

1. Air-Entraining: ASTM C260.
2. Chemical Admixtures: ASTM C494, non-corrosive and chloride free.
3. Chemical Admixtures for Flowing Concrete: ASTM C1017.
   a. Type 1, Water reducing, high range.
   b. Type 2, Water reducing and retarding, high range.

F. Water: Potable.

G. Premolded Joint Filler:

1. ASTM D1751.
2. ASTM D1752, Type I, II or III.
3. Closed Cell polyethylene.

H. Waterstops:

1. Virgin polyvinyl chloride (PVC) waterstop conforming to CRD C572.
2. Hydrophilic Type Waterstop:
   a. Hydrotite CJ-1020-2K by Greenstreak, Inc.
   b. Ultraseal MC-2010M by Adeka Ultra Seal.

3. Construction and Contraction Joints: PVC, dumbbell or serrated type, 6 in. wide by 3/8 in. thick, at center. If 4 in. wide waterstop indicated on Drawings, waterstop shall be 3/16 in. thick at center.

4. Use hydrophilic type waterstop only where noted on Drawings. Glue and nail to waterstop in accordance with waterstop manufacturer's recommendations.

5. Provide factory made prefabricated tees, crosses, and other configurations as required. Splice in accordance with manufacturer's written instructions.

I. Membrane Forming Curing Compound:

1. Manufacturers:

a. Dress and Seal 30 by L&M Construction Chemicals, Inc.

b. Super Floor Coat by Euclid Chemical Company.

c. Masterkure by Master Builders.

d. Kure-NSeal 30 by sonneborn.

e. Achro Seal AS-30 or AS-1 Achro Seal by TK Products.

2. ASTM C309, and compatible with scheduled finishes and coatings, except permeability shall not exceed 0.39 kg/m²/72 hrs.

J. Cement Grout: Mixture of cement and fine sand in proportions used in concrete being finished.

K. Epoxy Bonding Compound:

1. Manufacturers:

a. Sikadur Hi-Mod by Sika Corporation.

b. Euco Epoxy 452 MV or 620 by Euclid Chemical Company.

c. Resi-Bond J-58 by Dayton Superior.

d. Epobond by L&M Consturction Chemicals, Inc.

e. TK-310 Concrete Bonding Agent by TK Products.

2. Use when joining new to existing concrete.

3. Conforming to ASTM C881.

L. Non-Epoxy Bonding Compound:

1. Manufacturers:

a. Weld-Crete, by Larsen Products Corporation.

b. Acryl 60 by Thoro.

c. Acryl-Set by Master Builders.

d. Everbond by L&M Construction Chemicals, Inc.

e. Tk-225 Liquid Bonding Agent by TK Products

2. Use when joining new to existing concrete where bonding compound cannot be placed immediately prior to pouring of new concrete.

3. Conforming to ASTM C1059 Type II.

M. Preformed Control Joint Strips:

1. Manufacturers:

a. Zipcap by Greenstreak.

b. Ouick Strip by Schlegel Corporation.

2. Plastic joint former with locking tabs.

3. Depth: ¼ of slab thickness.

N. Epoxy Joint Filler:

1. Manufacturers:

a. Euco Epoxy 800 by Euclid Chemical Company.

b. Sikadur 51 by Sika Corporation.

c. MM-80 by Metzger/McGuire.

d. ResCon Flexresin R810 or ResCon Flexresin Paste R811 by Symons.

e. Epoflex SL by L&M Construction Materials, Inc.

f. Poxy-Fil J-52 by Dayton Superior.

g. Sikadur CJR by Sika Corporation.

2. Minimum Shore Hardness of 70.

O. Evaporation Retardant:

1. Manufacturers:

a. E-CON by L&M Construction Chemicals, Inc.

b. Confilm by Master Builders.

c. Eucobar by Eclid Chemical Company.

d. TK-2120 Tri-Film by TK Products.

e. SikaFilm by Sika Corporation.

P. Fiber Reinforcement:

1. Manufacturers:

a. Fibermesh Company.

b. W.R. Grace & Company.

c. Euclid Chemical Company.

d. Forta Corp.

2. ½ in. to ¾ in. collated fibrillated virgin polypropylene fibers.

3. ASTM C1116 Type III.

2.02 CONCRETE MIX DESIGN

A. Concrete Mix: Measure and combine cements, aggregates, water, and admixtures in accordance with ASTM C94 and ACI 211.1.

1. Cement: Shall be one brand from one source.

2. Air-Entrainment: Air entrain all concrete.

3. Chemical Admixtures: Use optional to aid concrete properties and allow for efficient placement. Manner of use and amount shall be in accordance with manufacturer's written recommendations and as approved by Engineer. Do not use admixtures which increase shrinkage or negatively affect finishing.

4. Fly Ash: Use is optional. Combine fly ash with cement at rate of 1.0 lb fly ash/lb reduction in cement. Amount of fly ash shall not be less than 15% nor more than 25% of weight of cement plus fly ash. When fly ash is used, minimum amount of cement given in table for Class of Concrete may be proportionately reduced Water to Cementitious ratio shall not exceed water to cement ratio given in table for Class of Concrete.

5. Ground Granulated Blast-Furnace Slag (GGBF Slag): Use is optional. Combine GGBF slag with cement at a 1.0 lb GGBF slag/lb reduction in cement. Amount of GGBF slag shall not be less than 25% nor more than 50% of weight of cementitious material. When GGBF slag is used, minimum amount of cement given in table for Class of Concrete may be proportionately reduced. Water to Cementitious ratio shall not exceed water to cement ratio given in table for Class of Concrete.

6. Fly Ash and GGBF Slag Mix Ternary Systems: Use is optional. Combinations of Portland cement, GGBF slag and fly ash will be allowed. Minimum amount of Portland cement shall be 337 lb/cubic yard of concrete. Total replacement of cement with fly ash and GGBF slag shall not exceed 50%. Total replac3emtn of cement with fly ash shall not exceed 25%. Water to Cementitious ratio shall not exceed water to cement ratio given in table for Class of Concrete.

7. Use no admixture other than specified, unless approved by Engineer.

8. Class B concrete fill shall be fiber reinforced:

   a. Dosage Rate: 1-1/2 lbs/cu yd minimum.

   b. Comply with manufacturer's recommendations and as specified in ASTM C94.

B. Class of Concrete:

1. Furnish in accordance with table. Cement contents listed are minimum values and shall be increased as required to attain other specified characteristic.

2. Air contents listed are for concrete requiring air-entrainment as specified herein. Contents listed shall be maintained after addition of admixtures.

3. Slumps listed are maximum, except when high range water reducer is used. Maximum slump when high range water reducer is used, 10 in.

4. Chloride ion content shall not exceed values listed in ACI 318, Table 4.3.1.

5. Mid-range water reducer: ASTM C494, Type A required for Class A concrete.

Class	Compressive Strength (psi)	Coarse Aggregate (maximum size)	Minimum Cement Factor (lbs/cu yd)	Air Content (%)	Slump (in.)	Water/Cement Ratio (maximum)
A	4,500	1-1/2 in.	517	5.5 ± 1.5	5.5 ± 1.5	0.42
B1	3,000	1-1/2 in.	423	5.5 ± 1.5	3 ± 1	N/A
B3	3,000	3/8 in.	470	7.5 ± 1.5	4 max	N/A
C	4,000	3/4 in.	564	6 ± 1.5	3 ± 1	
F	2,000	3/4 in.	212	-	-	-
Note: *Interior concrete floor with trowel-finished surface, limit air content to 3% max.*						

C. Concrete Usage:

1. Class A: Locations, except where Class B and C specified.
2. Class B: Tank fillets and where noted.
3. Class C: Exterior unreinforced concrete pavement and curbs.
4. Class F: Mud Slabs and Backfill below and around structures where noted.
5. Nominal maximum size of coarse aggregate shall be as noted in Table above, nor shall it exceed ¾ of minimum clear spacing between reinforcing bars, 1/5 of narrowest dimension between sides of forms or 1/3 of thickness of slab.

2.03 MODIFICATION OF MIX DESIGN

A. After sufficient test data available from Project, provisions of ACI 318 may be used to reduce amount by which average strength must exceed specified 28-day compressive strength provided.

1. Probable frequency of strength tests more than 500 psi below specified 28-day compressive strength will not exceed 1 in 100.
2. Probable frequency of average of 3 consecutive strength tests below specified 28-day compressive strength will not exceed 1 in 100.

B. Do not reduce cement content below minimum amount specified except as allowed in combination with fly ash and/or slag.

C. Submit verification of mix design.

2.04 MIXING AND DELIVERY

A. Use ready mixed concrete.

B. Deliver and complete discharge within 1-1/2 hrs of commencing of mixing or before 300 revolutions of drum or blades, whichever comes first. Includes revolutions required by transit mix trucks. Limitations may be waived by Engineer if concrete slump, after 1-1/2 hrs or 300-revolution limit reached, that concrete can be placed without addition of water. In hot weather, time or number of revolutions criteria may be reduced by Engineer.

C. Do not add water on-site.

D. Deliver concrete to site having temperature not less than 50ºF nor greater than 90ºF.

E. If high range water-reducing admixture added on-site, mix concrete at site additional 85 revolutions of drum after addition of high range water-reducing admixture.

PART 3 EXECUTION

3.01 FORMS

A. Formwork design, detailing, and installation shall be Contractor's responsibility and shall conform to requirements of ACI 347R.

B. Materials and Construction: Type of forms used is Contractor's option, except as otherwise indicated below or on Drawings. Plywood and other wood surfaces shall have smooth, level surfaces treated with form oil or sealer to produce clean release of concrete from forms.

1. Where walls remain exposed use plywood, prefabricated metal or wood forms. Do not use boards.

2. Use bolts, rods or other approved devices for form ties. Plastic cone snap ties are approved as form ties. Ties for liquid holding structures or dry structures below grade shall have integral water stop. Do not use wire ties on exposed concrete.

3. Ties shall be removed minimum of 1 in. from formed surface. Removal of ties shall leave holes clean cut and without appreciable spalling at face of concrete. Provide plastic cone or other approved device.

4. Provide ¾ in. chamfer on external corners of exposed concrete walls, beams, columns, equipment bases and exposed edges of construction joints. Do not chamfer columns flush with concrete block walls.

5. Provide openings at base of vertical forms as access for cleaning and inspection of forms and reinforcing prior to depositing concrete.

C. Treat or Wet Contact Forms: Coat plywood and wood moldings with non-staining form release agent. Apply release agent before reinforcement is placed.

D. Repairing and Cleaning: Clean, patch, and repair form material before reusing.

E. Workmanship:

1. Formwork shall prevent leakage of mortar, shall not deflect under weight of concrete and workman, and shall withstand fluid pressures of concrete.

2. Removal of wall ties shall leave holes clean cut and without appreciable spalling at face of concrete.

3.02 SUBGRADE PREPARATION

A. Provide mud slabs where noted, where necessary, and when required by Engineer to obtain dry and stable working platform for placement of slabs on grade. Unless otherwise approved by Engineer, mud slabs shall be provided between free-draining fill and foundation slabs as detailed. Mud slabs shall be 2 in. thick minimum.

B. Soak subgrade evening before placement and sprinkle ahead of placement of concrete.

C. Remove standing water, ice, mud, and foreign matter before concrete deposited.

3.03 PLACING CONCRETE

A. Notify Owner and testing Laboratory 24 hrs in advance of placing operation.

B. Place concrete, except as modified herein, in accordance with ACI 304R, Chapter V.

C. Concrete will not be allowed to drop freely where reinforcing will cause segregation of mix.

1. Super plasticized Concrete: 10 ft. maximum drop.

2. Other Concrete: 5 ft maximum drop.

D. If pumping is used, do not use aluminum piping for delivery system.

E. When placing of concrete is temporarily halted or delayed, provide construction joints as shown on Drawings and as specified.

F. Place in lifts not exceeding 24 in. and compact with internal mechanical vibrator equipment.

1. Insert vibrator so area visibly affected by vibrator overlaps adjacent just-vibrated areas by a few inches.

2. Slabs: Insert vibrators along each face (i.e., just behind reinforcing) and allow vibrator to sink into previous lifts as deep as it will penetrate.

3. Walls: Insert vibrators along each face (i.e., just behind reinforcing) and allow vibrator to sink into previous lifts as deep as will easily penetrate.

4. Along Water stop: Insert vibrators along full length of waterstop alternating on each side at 12 in. maximum centers.

5. Do not spread concrete with vibrators.

G. Provide bonding compound between new and hardened or existing concrete where shown on Drawings.

H. When heat or wind conditions will result in evaporation of 0.2 lb/sf/hr or more, use evaporation retardant in accordance with manufacturer's recommendations to minimize plastic shrinkage cracking.

3.04 JOINTS

A. Unless otherwise noted, construction joints shown are optional. Joints not shown on Drawings shall be approved by Engineer. Locate to miss splices in reinforcement.

B. Limit size of concrete pours. Maximum length of wall and slab pours shall not exceed 60 ft.

C. Before concrete placed, construction joints shall be cleaned, laitance removed and surface wetted. Remove standing water.

D. Locate construction joints in floors within middle third of span. Construction joints in floors supported by walls may be located at center of wall with Engineer's approval.

E. Locate vertical construction joints in walls minimum of one-half wall height from corners or other intersection walls or at midpoint between corners or intersecting walls. Locate horizontal joints in walls within middle third of wall height.

F. Construction joints shall have keys or roughened surfaces. Where roughened surface used, surface shall have amplitude of ¼ in. minimum.

G. Install premolded joint filler where noted in accordance with manufacturer's recommendations. Joint filler shall be compatible with sealant and suitable for intended purpose.

H. Clean and prime joints in accordance with manufacturer's written instructions before applying sealant.

3.05 WATERSTOPS

A. Provide waterstop in construction joints in:

1. Walls and slabs separating dry interior from earth or liquid.
2. All construction joints in liquid holding tanks.
3. Locations shown on Drawings.

B. Installation: Secure waterstop utilizing hog rings or grommets spaced maximum 12 in. on center and within 1 in. of edge. Wire tie to adjacent reinforcements.

C. Splice joints in waterstop to form continuous watertight diaphragm. Splice in accordance with manufacturer's recommendations.

3.06 EMBEDDED ITEMS

A. Cast pipe and other embedded items into concrete as placement progresses. Do not provide blockouts unless specifically noted on Drawings.

B. Following restrictions shall be adheared to, except for slabs on grade, unless otherwise noted.

1. Duct, conduit, pipe, and fittings, when placed within slab and walls, shall not be larger than 1/3 thickness of slab or wall nor placed closer than 3" outside dia clear from each other.
2. Reinforcing steel shall be in-place before embedded items placed and reinforcing cut or removed shall be replaced with additional reinforcing as indicated on Drawings or approved by Engineer.

C. Do not place ducts, conduits, and pipes in slabs on grade. Place minimum 4 in. under bottom of slab.

D. Set items such as bolts, anchors, piping, and frames in concrete as shown on Drawings.

E. Set miscellaneous items according to templates and setting diagrams.

F. Place items constructed of dissimilar metals to avoid physical contact with reinforcing. Secure item and reinforcing to ensure they will not shift, and come into contact during pouring. Contact between reinforcing and other metal, other than bare, coated or plated carbon steel not permitted, unless approved by Engineer.

G. Support wall pipes from formwork to prevent contact with reinforcing.

H. Other Contractors furnishing embedded items to be cast into concrete shall be responsible for setting and maintaining alignment during concrete placing operations.

3.07 REPAIR OF SURFACE DEFECTS

A. General:

1. Prior to starting repair work, except as specified otherwise, obtain Engineer's approval of proposed repair techniques and mixes.
2. Develop patching techniques and mixes on portion as as-cast surface selected by Engineer for this purpose. Dress surface of patches remaining exposed to view to match color and texture of adjacent surfaces.

B. Tie Holes:

1. Fill tie holes, except where sealant is indicated, with patching mortar (Sikatop, by Sika Corporation or equal).

C. Defective Areas:

1. Remove honeycombing, stone pockets, spalls, and other defective concrete down to sound concrete. If chipping required, make edges perpendicular to surface. Do not feather edges.
2. Fill defective area with patching mortar (Sikatop, by Sika Corporation or equal).

D. Leaks or Wet Spots:

1. Patch and repair areas where leaks or wet spots have occurred inside of dry structure.
2. Patch and repair areas where leaks or wet spots have occurred in wet wells , basins, tanks, reservoirs, and other structures which are to hold wastewater.
3. Repair method shall be Contractor's, subject to requirements of these specifications and reviewed by Engineer.

3.08 FINISHING SLABS AND FLATWORK

A. Slab Finishes:

Description	Concrete Finish
Surfaces to Receive Grout or Topping	Float
Submerged and Buried Slabs	Float
Exterior Exposed Slabs	Float and Broom Finish
Exterior Stairs, Ramps, Walks	Float and Broom Finish

B. After placement, screed concrete with straightedges, power strike-offs or vibrating screeds.

C. After screeding, bull float or darby surface to eliminate ridges and to fill in voids left by screeding.

D. Float:

1. Use magnesium or aluminum hand floats or power floats with slip on float shoes after concrete has stiffened to point where ¼ in. maximum indentation can be imparted by normal foot pressure. Do not use combination blades for floating.
2. Float finish shall result in uniform smooth granular texture.
3. After floating, check slab tolerances with 10-ft straightedge. Fill low spots with fresh concrete.

4. Do not sprinkle with dry cement or add water.

E. Broom Finish: Use fine, soft-bristled broom and broom at right angles to direction to traffic to give nonskid finish. Texture shall be approved by Engineer.

3.09 FINISHING FORMED CONCRETE

A. Smooth Finish: Interior concrete surfaces permanently exposed to view, interior surface of tanks exposed to view extending 6-in. below liquid level, and concrete surfaces scheduled to be painted.

1. After removal of forms, patch or point up defects as specified and cure.
2. Grind joint marks and fins smooth with adjacent surface. Remove oil stains and rinse surface.
3. After grinding and cleaning, dampen concrete and paint entire surface with Cement Grout. Work Cement Grout into surface with cork or other suitable float. When grout has set to where it will not be pulled out of holes or depressions, brush off surface with dry burlap or carpet.

B. Rubbed Finish: Exterior cast-in-place concrete surfaces permanently exposed to view extending to 6 in. below finish grade or liquid level unless otherwise and where indicated on Drawings.

1. After removal of forms, patch or point up defects as specified and cure.
2. Remove joint marks, fins, and stains as described for smooth finish.
3. Apply heavy coat of Finishing Grout. After first coat has set, apply second coat. When second coat has set, float to uniform texture.
4. Follow manufacturer's written instructions for finishing concrete.
5. Finish color shall be gray.

3.10 PROTECTION AND CURING

A. Protect concrete from frost and keep moist for minimum curing period of 7 days after placing in accordance with ACI 308.

B. Formed Surfaces:

1. Wet cure by spraying surfaces during curing period as frequently as drying conditions may require to keep concrete surfaces moist.
2. Walls may be cured by leaving forms in-place. For vertical surfaces, apply water to run down on insides of forms, if necessary, to keep concrete wet.
3. After forms are removed, wet cure for remainder of curing period or apply curing compound.
4. Do not use curing compound where epoxy, urethane, mortar bed, grout, additional concrete or other coatings or adhesives will be applied.

C. Concrete Flatwork:

1. Start curing activities as soon as free water has disappeared from surface of concrete after placing and finishing.
2. Cure flatwork using liquid curing compound or wet cure.

3. Do not use curing compound where epoxy, urethane, mortar bed, grout, additional concrete or other coatings or adhesives will be applied.

D. Curing Compound:

1. Apply curing compound at uniform rate sufficient to comply with requirements for water retention as specified and as measure in accordance with ASTM C156.

2. Cover areas subjected to direct sunlight during curing period with ambient temperature expected to exceed 80ºF with white pigmented compound, others may be covered with fugitive dye compound.

E. Protect from damaging mechanical disturbances, particularly load stresses, heavy shock, and excessive vibration.

F. Protect finished concrete surfaces from damage caused by construction equipment, materials or methods, and rain or running water.

G. Do not load self-supporting structures to overstress concrete.

3.11 REMOVAL OF FORMING AND SHORING

A. Do not remove forming or shoring until member supported has acquired sufficient strength to safely support own weight and any imposed loads. Forming shall remain in place for at least minimal time recommended by ACI 347R. In addition, forming for horizontal members such as elevated slabs and beams shall remain in place minimum of 7 days. In no case shall forming for horizontal members be removed before concrete as reached at least 70% of its specified design strength.

B. Reshore areas as required to carry additional imposed loads.

C. Repair damage to structure caused by early removal of forming and shoring at no additional cost to Owner.

3.12 FIELD QUALITY CONTROL

A. Concrete will be sampled in accordance with ASTM C172. Cylinders will be transported to place on-site where they can be stored under conditions affecting concrete they represent without being disturbed for first 24 hrs.

B. Slump tests will be made daily and when requested by Engineer, in accordance with ASTM C143. Slump tests will be made from same batch from which strength tests are made.

C. When air-entrained concrete is used, air content tests will be made daily and when requested by Engineer in accordance with ASTM C231. Pumped concrete will be tested at pipe discharge.

D. If measured slump or air content falls outside limits specified, check test will be made immediately on another portion of same sample. In event of second failure, concrete shall be considered to have failed to meet requirements of Specifications and will be rejected.

E. Strength test for each class of concrete will consist of 4 cured standard cylinders made from composite samples secured from single load of concrete in accordance with ASTM C172. Compressive strength tests will be made on 1 cylinder at 7 days and 2 cylinders at 28 days. Test results at 28 days shall be average strength of 2 specimens as determined in accordance with ASTM C39, except if 1 specimen in test shows manifest evidence of

improper sampling, molding or testing, it will be disregarded. Remaining cylinder will be tested if needed.

F. Strength test will be made for each following condition for each class of concrete.

1. Each day's pour.
2. Each change of source.
3. Each 100 cu yds of concrete poured.
4. When temperatures are below or expected to fall below 45ºF within 48 hrs after concrete placed, 2 additional cylinders will be made and cured in field under conditions approximating conditions affecting concrete they represent. One will be tested at 7 days, other at 28 days.

G. Strength level of individual class of concrete considered satisfactory if following requirements met.

1. Average of all sets of 3 consecutive strength tests equal or exceed specified 28-day compressive strength.
2. No individual strength test falls below specified 28-day compressive strength by more than 500 PSI.

H. If analysis of strength tests indicates above requirements are not being met, make immediate adjustments to mix. Also, if likelihood of low strength concrete is confirmed, additional tests will be made as required by Engineer to determine strength of concrete in-place is not in conformance with Specification, Engineer will determine whether nor not Work in-place is adequate for intended use in location. If Work is determined inadequate, Contractor shall follow such remedial or replacement measures with Engineer may require. Contractor shall bear costs in connection with testing, engineering analyses, remedial work, and replacement required under terms of this paragraph.

END OF SECTION

SECTION 03390

CONCRETE CURING

PART 1 GENERAL

1.01 WORK INCLUDES

A. Concrete curing materials and methods.

1.02 SUBMITTALS

A. Manufacturer's application instructions for curing compound.

1.03 REFERENCES

A. ACI 301 – Specifications for Structural Concrete for Buildings.

B. ACI 308 – Standard Practice for Curing Concrete

C. ASTM C171 – Sheet Materials for Curing Concrete

D. ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

E. ASTM C1315 – Standard Specification for Liquid Membrane-Forming Compounds having Special Properties for Curing and Sealing Concrete.

F. ASTM D2103 – Polyethylene Film and Sheeting.

G. Where these Specifications differ, the more stringent requirements shall apply.

1.04 QUALITY ASSURANCE

A. Conform to requirements of ACI 301 and ACI 308.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Maintain ambient temperature at a minimum of 50 degrees Fahrenheit for 72 hours for curing concrete.

PART 2 PRODUCTS

A. Water based, high solids content non-yellowing curing compound meeting the following requirements:

1. Membrane Curing Compound: ASTM C309.

2. Polyethylene Film: ASTM D2103, 6-mil thick; clear, opaque, or black color.

PART 3 EXECUTION

3.01 INSPECTION

A. Verify concrete surfaces are ready for curing.

3.02 CURING

A. All concrete shall be cured in general conformance with ACI 301 requirements.

B. Develop curing procedures in general conformance to ACI 308.1.

C. Cure concrete in walls using one of the following methods:

1. Option 1 – Leave form Work in place and keep forms and exposed concrete surfaces continuously wet for 7 days.

2. Option 2 – Remove forms and apply curing compound.

3. Option 3 – Remove forms and keep concrete surfaces wet for 7 days.

D. Cure concrete in slabs using one of the following methods:

1. Option 1 – Maintain ponded water on exposed surface for 7 days.

2. Option 2 – Cover exposed surface with wet burlap. Keep burlap wet for 7 days. Remove and dispose of burlap after curing is completed.

3. Option 3 – Apply curing compound to exposed surface. Do not apply curing compound to surfaces of construction joints.

E. Apply curing compound in accordance with manufacturer’s instructions.

F. Remove absorptive mat, sheeting, and/or ballast as applicable after curing.

3.03 MEMBRANE CURING COMPOUND

A. Apply curing compound in two coats, with second coat at right angles to first.

B. Apply in accordance with manufacturers' instructions.

3.04 SPRAYING

A. Spray water over areas; maintain continuously moist for a minimum of 7 days.

3.05 POLYETHYLENE FILM

A. Spread polyethylene film over areas. Lap edges and ends 3 inches and seal with pressure-sensitive polyester tape.

B. Maintain in place with plywood sheets for 7 days.

END OF SECTION

SECTION 03620

NON-SHRINK GROUT

PART 1 GENERAL

1.01 SUMMARY

A. The Work described in this Specification includes the following general items of Work:

1. Furnishing and placing the following grout types:

a. Cement based non-shrink grout (Type 1),

b. Non-shrink epoxy grout (Type 2),

c. Epoxy anchor grout (Type 3), and

d. Cement-bentonite non-shrink grout (Type 4).

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):

a. ASTM C109 – Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-in or 50mm Cube Specimens.

b. ASTM C579 – Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings.

c. ASTM C1107 – Standard Specification for Packaged Dry, Hydraulic Cement Grout (Non-shrink).

d. ASTM C939 – Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).

e. ASTM C827 – Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.

f. ASTM C531 – Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings.

g. ASTM C1181 – Test Method for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.

h. ASTM C882 – Test Method for Bond Strength of Epoxy Resin Systems Used with Concrete.

i. ASTM C881 – Specification for Epoxy-Resin-Based Bonding Systems for Concrete.

2. American National Standards Institute (ANSI):

a. ANSI/ASTM D1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

b. ANSI/ASTM D1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

1.03 SUBMITTALS

A. Shop Drawings:

1. Product Data of all grouts.
2. Proposed method for keeping existing concrete surfaces wet prior to placing grout.
3. Forming method for fluid grout placements.
4. Curing method for all grouts.

B. Administrative:

1. Manufacturer’s instructions.
2. Statement of Qualifications for grout manufacturer.

C. Quality Control:

1. Manufacturer's written instructions:
   a. Cement-water ratio of grout topping.
   b. Mixing of grout.
2. Manufacturer's Certificate of Compliance:
   a. Grout free from chlorides and other corrosion-causing chemicals.
   b. Non-shrink grout properties of Type 2 and 3, verifying expansion at 3 or 14 days will not exceed the 28-day expansion and non-shrink properties are not based on gas or gypsum expansion.
   c. Statement of Qualifications for non-shrink grout manufacturer's representative.

1.04 QUALIFICATIONS

A. Non-shrink grout manufacturer shall have a minimum of 1 year experience in installation of similar grouting or grout placement.

PART 2 PRODUCTS

2.01 CEMENT

A. Cement for grout shall conform to the requirements of Section 03050: BASIC CONCRETE MATERIALS.

2.02 CEMENT BASED NON-SHRINK GROUT (Type 1)

A. Type 1 non-shrink grout shall have a minimum 28-day compressive strength of 10,000 psi, when mixed at a fluid consistency.

B. Type 1 non-shrink grout shall meet the requirements of ASTM C1107, Grade C, when tested using the amount of water needed to achieve the following properties:

1. Fluid consistency (20 to 30 seconds) per ASTM C939.
2. At temperatures of 45, 70, and 90ºF.
3. The grout when tested shall not bleed or segregate at maximum allowed water.

C. Provide certification that the expansion at 3 or 14 days does not exceed the 28-day expansion and that its non-shrink property is not based on gas production or gypsum expansion.

D. Fluid grout shall pass through the flow cone, with a continuous flow, 1 hour after mixing.

E. Grout shall be pretested per the specified grout test requirements.

F. Type 1 non-shrink grout shall be Masterflow 928 by BASF Corporation; or equal.

2.03 NON-SHRINK EPOXY GROUT (Type 2)

A. Type 2 grout shall be a flowable, non-shrink, 100 percent solids system. Type 2 grout shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive 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.

B. Provide certification that the vertical volume change at all times before hardening shall be between 0.0 percent shrinkage and 4.0 percent expansion when measured according to ASTM C827 (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1).

C. Provide certification that the length change after hardening shall be negligible (less than 0.0006 in/in) and the coefficient of thermal expansion shall be less than 0.00003 in/in ºF when tested according to ASTM C531.

D. The compressive creep at one year shall be negligible (less than .001 in/in) when tested under a 400 psi constant load at 140ºF according to ASTM C1181.

E. The 7-day compressive strength shall be minimum 15,000 psi when tested according to ASTM C579, modified to 1-1/2-inch square cubes.

F. The grout shall be capable of maintaining a flowable consistency for a minimum of 30 minutes at 70ºF.

G. The shear bond strength to Portland cement concrete shall be greater than the shear strength of the concrete when tested according to ASTM C882.

H. Do not reduce aggregate loading or add solvents to increase flowability.

I. Type 2 grout shall be Five Star HP Epoxy Grout by Five Star Products, Inc.; Masterflow 648 CP Plus by Degussa; or equal.

2.04 EPOXY ANCHOR GROUT (Type 3)

A. Type 3 grout shall conform to ASTM C881, Type IV, Class B and C, Grade 3.

B. Manufacturer shall certify that the epoxy grout will maintain 90 percent of the required strength up to a temperature of 140ºF.

C. Type 3 grout shall come in two-chambered cartridge with a metering system that provides the proper ratio of hardener and resin. The grout shall also come with a static mixer nozzle to thoroughly mix the hardener and resin together.

D. Type 3 grout shall be capable of being used in submersed applications.

E. If average working temperature will be over 100ºF, use cement based non-shrink grout.

2.05 CEMENT-BENTONITE NON-SHRINK GROUT (Type 4)

A. Type 4 grout shall be a mixture of cement, pulverized bentonite, and water. The cement-bentonite mixture shall contain 10 gallons of water and between 4 to 6 pounds of bentonite for each 94-pound sack of cement. The cement and water shall be mixed first. Then:

1. For Type 4 grout that is to be pumped into a borehole, add bentonite to the cement-water mixture to form a smooth, consistent slurry that is as thick as possible while still being pumpable.

2. For Type 4 grout that will be placed as backfill, add bentonite to the cement-water mixture to form a smooth, consistent slurry that is as thick as possible while still being placeable.

3. The amount of bentonite added will vary depending on the application and desired mixture consistency.

PART 3 EXECUTION

3.01 GENERAL

A. Grout shall not be placed until base concrete or masonry has attained its design strength, unless authorized by ENGINEER.

B. When cementitious grouts are used on concrete surfaces, the concrete surface shall be saturated with water for 24 hours prior to placement. Upon completion of saturation period excess water shall be removed. Concrete substrate shall not be wet prior to placement of grouts.

C. Except for cement-bentonite grout all surfaces that will be in contact with grout shall be free of grease, oil, dirt, loose rust, curing compounds, laitance, loose concrete, and other deleterious materials.

3.02 GROUTING PROCEDURES

A. General:

1. 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. Base Plate Grouting:

1. Provide a ¾-inch-thickness of grout, ½-inch minus tolerance.

2. After the base plate has been set in position, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink grout. The mixture shall be of a trowelable consistency and tamped or rodded into the space between the plate and the base concrete.

C. Epoxy Anchor Grout:

1. Grout shall be proportioned and mixed with automatic equipment.

2. Unless otherwise indicated by the manufacturer, embedment shall be sufficient to develop the ultimate tensile strength of the anchor or reinforcing bar, but shall not be less than 8 diameters for threaded rod, or 12 diameters for reinforcing or smooth bars.

D. Topping Grout and Concrete Fill:

1. All mechanical, electrical, and finish Work shall be completed prior to placement of topping or concrete fill. To ensure bonding to the base slab, the base slab shall be given an exposed finish.

2. The minimum thickness of grout topping and concrete fill shall be 1 inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.

3. The base slab shall be thoroughly cleaned and wetted to saturated surface dry, prior to placing topping and fill.

4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.

5. The surface shall be tested with a straight edge to detect high and low spots, which shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand troweling. During finishing, no water, dry cement, or mixture of dry cement and sand shall be applied to the surface.

E. Cement Based Non-Shrink Grout Used for Anchor Bolts:

1. When the bolt diameter is 1 inch or less, the hole diameter should be a minimum of 2 inches. When the bolt's diameter is greater than 1 inch, the hole diameter should be at least twice the bolt diameter.

2. The non-shrink grout should be placed in the holes in a non-sag (trowelable) consistency. The grout should be placed in the holes before the anchor and then the anchor inserted and vibrated to ensure proper coverage.

3.03 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.

3.04 CURING

A. Grout should be cured according to the manufacturer's recommendations.

B. Temperature of the foundation plate, supporting concrete foundation, and the grout should be maintained between 40ºF and 90ºF during grouting, and for a minimum of 24 hours afterward. Machinery and baseplates will cool at low temperatures or heat up at hot temperatures or in the sun more rapidly than the grout and should be avoided during the curing period.

C. Cement based grout should be protected from extreme drying conditions by covering all exposed grout surfaces with continually wetted burlap for a minimum of 3 days. Immediately after the moist curing period, two coats of a curing compound shall be applied.

END OF SECTION

SECTION 03900

CONCRETE RESTORATION AND CLEANING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Cleaning of existing concrete surfaces.
2. Epoxy repair of cracks in existing concrete surfaces.
3. Patching of existing deteriorated concrete surfaces.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO) M-235 – Epoxy Resin Adhesives.

B. American Concrete Institute (ACI) 302.1 - Guide for Concrete Floor and Slab Construction.

C. American Society for Testing and Materials (ASTM):

1. C78 - Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).
2. C109 - Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50-mm Cube Specimens).
3. C266 - Test Method for Time of Setting of Hydraulic Cement Paste by Gillmore Needles.
4. C348 - Test Method for Flexural Strength of Hydraulic Cement Mortars.
5. C666 - Test Method for Resistance of Concrete to Rapid Freezing and Thawing.
6. C672 - Test Method for Scaling Resistance of Concrete Surfaces Exposed to Deicing Chemicals.
7. C881 - Specification for Epoxy-Resin Base Bonding Systems for Concrete.
8. C882 - Test Method for Bond-Strength of Epoxy-Resin Systems Used with Concrete.
9. C883 - Test Method for Effective Shrinkage of Epoxy-Resin Systems Used with Concrete.
10. C928 - Specifications for Packaged, Dry, Rapid-Hardening Cementitious Materials for Concrete Repairs.
11. C944 - Standard Test Method for Abrasion Resistance of Concrete or Mortar Surfaces by the Rotary-Cutter Method.
12. C1202 - Test Method for Electrical indication of Concrete's Ability to Resist Chloride Ion Penetration.

13. C1042 - Test Method for Comparing Concrete on the Basis of Bond Developed with Reinforcing Steel.
14. C1059 - Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
15. D570 - Test Method for Water Absorption of Plastics.
16. D638 - Test Method for Tensile Properties of Plastics.
17. D695 - Test Method for Compressive Properties of Rigid Plastics.
18. D790 - Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

1.03 SUBMITTALS

A. Product Data: Include manufacturer's specifications, surface preparation and application instructions, and protection of adjacent surfaces.

B. Test Data: Confirm compliance with specified requirements.

1.04 PROJECT CONDITIONS

A. Apply materials within temperature range recommended by manufacturer.

B. Ensure adequate ventilation in application areas.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Dayton Superior Corporation or similar

2.02 MATERIALS - CLEANERS

A. Floor Cleaner, Degreaser, and Stripper:

1. Product: Concrete Floor Cleaner and Degreaser (J-47)
2. Description: Water soluble cleaning and degreasing solution.

B. Floor Cleaner, Degreaser, and Stripper:

1. Product: Citrus Peel (J-48)
2. Description: Water soluble, biodegradable, cleaning, degreasing, and stripping solution.

2.03 MATERIALS - CEMENTITIOUS PATCHING COMPOUNDS

A. Patching Compound:

1. Product: HD-50
2. Description: Fast setting, cement based, fiber reinforced, latex modified, heavy duty concrete patch for horizontal surfaces and vertical and overhead form-and-pour" applications.
3. Pourable and pumpable.
4. Meet ASTM C 928.

5. Compressive strength: Tested per ASTM C 109 with following results:
    a. Test Age Compressive Strength - psi (MPa)
    b. At 75 degrees F (24 degrees C) At 40 degrees F (4 degrees C)
    c. 1 hour 2500 (17.2) - - -
    d. 3 hours 3500 (24.1) 2700 (18.6)
    e. 1 day 6145 (42.4) 6100 (42.1)
    f. 7 days 7370 (50.8) 6860 (47.3)
    g. 28 days 7990 (55.1) 7800 (53.8)
6. Bond strength: Tested per ASTM C 882 with following results:
    a. Test Age Bond Strength - psi (MPa)
    b. 1 day 1950 (13.4)
    c. 7 days 2550 (17.6)
7. Length change: Tested per ASTM C 928 with following results:
    a. Test Age Water Storage Air Storage Differential
    b. 28 days Plus 0.03 percent Minus 0.09 percent 0.12 percent
8. Freeze/thaw scaling resistance: 0.71 pounds per square foot (0.34 kg/sq m), average of three specimens, tested per ASTM 672.
9. Rapid freeze-thaw test: Average weight loss of 0.3 percent after 300 cycles, tested per ASTM C 666, Method B.
10. Chloride ion permeability: Tested per ASTM C1202.
    a. Elapsed time: 360 minutes
    b. Total charge passed through specimen: 646 coulombs
    c. Chloride permeability rating: Very low

B. Patching Compound:
1. Product: Day-Chem Perma Patch
2. Description: Fast setting, cement based, fiber reinforced, silica fume, heavy duty concrete patch for horizontal surfaces.
3. Meet ASTM C 928.
4. Compressive strength: Tested per ASTM C109 with following results:
    a. Test Age Compressive Strength - psi (MPa)
    b. 1 hour 2500 (17.2)
    c. 3 hours 4000 (27.6)
    d. 1 day 5200 (35.8)
    e. 7 days 9000 (62.0)
    f. 28 days 10,800 (74.5)
5. Length change: Tested per ASTM C928 with following results:

6. Test Age Water Storage Air Storage Differential 28 days Plus 0.03 percent Minus 0.07 percent 0.10 percent.

7. Freeze/thaw scaling resistance: 0.1 pound per square foot (0.5 kg/0.9 sq m), average of three specimens, tested per ASTM672.

C. Patching Compound:

1. Product: Thin Resurfacer.

2. Description: Cement based, polymer modified concrete patching and resurfacing compound for horizontal applications from 1/8 to 1/2 inch (3 to 13 mm).

3. Compressive strength: Tested per ASTM C109 with following results:

   a. Test Age Compressive Strength - psi (MPa)

   b. 1 day 1600 (11.0)

   c. 3 days 3200 (22.0)

   d. 7 days 5700 (39.3)

   e. 28 days 6700 (46.2)

4. Bond strength: Tested per ASTM C1042 with following results:

   a. Test Age Bond Strength – psi (MPa)

   b. 7 days 2700 (18.6)

   c. 28 days 3500 (24.1)

5. Flexural strength: 1100 psi (7.6 MPa), tested per ASTM C78 at 28 days.

D. Patching Compound:

1. Product: Polyfast

2. Description: Cement based, polymer modified, shrinkage compensating concrete patching compound for vertical and overhead applications.

3. Meet ASTM C928.

4. Compressive strength: Tested per ASTM C109 with following results:

   a. Test Age Compressive Strength - psi (MPa)

   b. 1 day 4100 (22.2)

   c. 3 days 6500 (44.8)

   d. 7 days 8100 (55.8)

   e. 28 days 9000 (62.0)

5. Bond strength: 5100 psi (35.1 MPa), tested per ASTM C1042 at 7 days.

6. Flexural strength: 2000 psi (13.8 MPa), tested per ASTM C348 at 28 days.

7. Chloride ion permeability: Tested per ASTM C1202.

   a. Elapsed time: 360 minutes

b. Total charge passed through specimen: 8 coulombs

c. Chloride permeability rating: Negligible

8. Length change: Tested per ASTM C928 with following results:

9. Test Age Water Cure Air Cure 28 days Minus 0.027 percent Minus 0.03 percent.

E. Patching Compound:

1. Product: Re-Crete 20 Minute Set with Ad Bond (J-40).

2. Description: Cement based patching compound with accelerators.

3. Compressive Strength: Tested per ASTM C109 with following results:

a. Test Age Compressive Strength - psi (MPa)

b. 1 day 2250 (15.5)

c. 3 days 5100 (35.2)

d. 28 days 8000 (55.1)

F. Patching Compound:

1. Product: Water Stop

2. Description: Noncorrosive, non-rusting, hydraulic cement

3. Compressive Strength: Tested per ASTM C109 with following results:

a. Test Age Compressive Strength - psi (MPa)

b. 1 hour 975 (6.7)

c. 24 hours 1870 (12.9)

d. 3 days 2950 (20.3)

e. 7 days 3650 (25.1)

f. 28 days 5910 (40.7)

4. Setting time: 2-1/2 minutes initial, 3-1/2 minutes final; tested per ASTM C266. Include one of the following epoxy adhesives for patching, resurfacing, and anchoring.

2.04 MATERIALS - EPOXY ADHESIVES

A. Epoxy Adhesive:

1. Product: Sure Level Epoxy (J-57)

2. Description: Two component, pre-proportioned, 100 percent solids, low modulus, high strength, low viscosity epoxy.

3. VOC compliant.

4. Tested to ASTM C881, Type 3, Grade 1, Classes B and C.

5. Compressive strength: 7500 psi (51.7 MPa) in 24 hours, tested per ASTM D579.

6. Bond strength: 1600 psi (11.0 MPa) at 14 days, tested per ASTM C882.

7. Tensile strength: 2500 psi (17.2 MPa), tested per ASTM D638.

B. Epoxy Adhesive:

1. Product: Sure-Anchor I (J-51)
2. Description: Two-component, pre-proportioned, 100 percent solids, fast setting, moisture insensitive epoxy adhesive.
3. Tested to ASTM C881, Types 1, 2, 4, and 5, Grade 3, Classes B and C.
4. VOC compliant.
5. Compressive strength: 10,600 psi (73.0 MPa), tested per ASTM D695 at 7 days.
6. Modulus of elasticity (compressive): 500,000 psi (3447 MPa), tested per ASTM D695.
7. Water absorption: 0.9 percent, tested per ASTM D570.
8. Concrete pullout resistance: See manufacturer data

2.05 MATERIALS - EPOXY CRACK REPAIR

A. Epoxy Adhesive:

1. Product: Sure-Inject (J-56)
2. Description: Two component, pre-proportioned, 100 percent solids, low viscosity epoxy adhesive.
3. VOC compliant.
4. Tested to ASTM C881, Types 1, 2, 4, and 5, Grade 1, Classes B and C.
5. Compressive strength: Minimum 13,000 psi (89.6 MPa), tested per ASTM D695.
6. Concrete bond strength: 2000 psi (13.8 MPa) at 14 days, tested per ASTM C882.
7. Tensile strength: 7400 psi (51 MPa) at 7 days, tested per ASTM D638.
8. Water absorption: 0.23 percent, tested per ASTM D570.
9. Shrinkage: Tested per ASTM C883.

2.06 MATERIALS - EPOXY REINFORCING SPRAY

Include the following for an epoxy spray for protecting reinforcing steel.

A. Epoxy Reinforcing Spray:

a. Product: Rebar Epoxy Spray (J-62)
b. Description: Epoxy coating in self-contained spray applicator.
c. Color: Green

2.07 MATERIALS - BONDING AGENTS

A. Epoxy Adhesive:

1. Product: Resi-Bond (J-58)

2. Description: Two component, pre-proportioned, 100 percent solids, high modulus, medium viscosity epoxy adhesive.
3. VOC compliant.
4. Tested to ASTM C 881, Types 1, 2, 4, and 5, Grade 2, Classes B and C and AASHTO M-235, Class III - Standard Version.
5. Compressive strength: Minimum 10,400 psi (71.7 MPa) in 7 days, tested per ASTM D695.
6. Concrete bond strength: 2550 psi (17.6 MPa) at 2 days and 3150 psi (21.7 MPa) at 14 days, tested per ASTM C882.
7. Tensile strength: 7580 psi (52.3 MPa) at 7 days, tested per ASTM D638.
8. Water absorption: 0.13 percent, tested per ASTM D570.
9. Modulus of elasticity: 275,000 psi (1896 MPa), tested per ASTM D695.

B. Bonding Agent:

1. Product: Day-Chem Ad Bond (J-40)
2. Description: Non-reemulsifiable, acrylic latex emulsion bonding agent.
3. Tested to ASTM C 1059, Type II.
4. Bond strength: Tested per ASTM C 1042, Type II with following results:
   a. Test Age Compressive Strength - psi (MPa)
   b. 14 days 1865 (12.9)
   c. 28 days 2436 (16.8)

2.08 ACCESSORIES

A. Sand: Clean, well graded silica sand.

B. Aggregate: 3/8 inch (10 mm) clean, washed pea gravel.

2.09 MIXING

A. Mix materials in accordance with manufacturer's instructions.

B. Epoxy Patching Compound: Add sand to mixed epoxy adhesive in accordance with manufacturer's instructions.

C. Cementitious Patching Compound: Mix aggregate with patching compound at rate not to exceed manufacturer's recommended ratio.

D. Do not over-water or retemper mixes.

PART 3 EXECUTION

3.01 APPLICATION - EPOXY REINFORCING SPRAY

A. Follow manufacturer's instructions.

B. Apply to exposed reinforcing steel in several light, even coats.

3.02 APPLICATION - BONDING AGENTS

A. Follow manufacturer's instructions.

B. Place patching compounds within time period recommended by manufacturer, or recoat.

3.03 APPLICATION - INTERIOR EPOXY MORTAR

A. Follow manufacturer's instructions.

B. Prime prepared substrate with mixed neat epoxy adhesive.

C. Apply epoxy mortar before primer becomes tack free.

D. Place in maximum 1 inch (25 mm) lifts. Allow each lift to cure before placing next lift.

E. Minimum thickness: 1/4 inch (6 mm)

3.04 APPLICATION - EXTERIOR EPOXY MORTAR

A. Follow manufacturer's instructions.

B. Prime prepared substrate with mixed neat epoxy adhesive.

C. Apply epoxy mortar before primer becomes tack free. Contact Dayton Superior for thicknesses exceeding 1/2 inch (13 mm).

D. Thickness: 1/4 inch (6 mm) minimum to 1/2 inch (13 mm) maximum. Do not use the following for exterior slabs-on-grade.

3.05 APPLICATION - EPOXY BROADCAST OVERLAY

A. Follow manufacturer's instructions.

B. Prime prepared substrate with mixed neat epoxy adhesive.

C. Apply mixed epoxy before primer becomes tack free, using notched squeegee.

D. After material levels, broadcast sand slowly over surface at rate of 2 pounds per square foot (10 kg/sq m); allow to settle into epoxy binder. Remove excess sand after epoxy sets.

E. After first coat has dried, apply second coat of epoxy and sand.

3.06 APPLICATION - EPOXY CRACK REPAIR

A. Follow manufacturer's instructions.

B. Space injection holes at 8 to 36 inch (200 to 900 mm) intervals depending on crack width and thickness of member.

C. Set injection ports in epoxy adhesive and allow to cure.

D. Seal cracks with epoxy adhesive to prevent loss of injected epoxy.

E. Inject epoxy to refusal.

F. After curing, remove injection ports and grind surfaces smooth.

3.07 PATCHING HORIZONTAL SURFACES - CEMENTITIOUS COMPOUNDS

A. Follow manufacturer's instructions.

B. Saw cut perimeter of area to be repaired.

C. Wet surfaces or apply bonding agent.

D. Thoroughly work repair material into substrate.

E. Float or trowel smooth and flush with adjacent surfaces.

F. Finish to match texture of surrounding concrete.

G. Cure surfaces immediately after finishing to prevent moisture loss; apply curing compound or use wet burlap except use insulated blankets during cold weather.

3.08 PATCHING VERTICAL AND OVERHEAD SURFACES - CEMENTITIOUS COMPOUNDS

A. Follow manufacturer's instructions.

B. Wet surfaces or apply bonding agent.

C. Thoroughly work material into substrate without voids.

D. Float or trowel smooth and flush with adjacent surfaces.

E. Finish to match texture of surrounding concrete.

F. Cure surfaces immediately after finishing to prevent moisture loss; apply curing compound or use wet burlap except use insulated blankets during cold weather.

END OF SECTION

SECTION 05100

STRUCTURAL STEEL AND MISC. METALWORK

PART 1 GENERAL

1.01 WORK INCLUDES

A. Providing all labor, materials, equipment, tools and services necessary to furnish and install all structural steel and miscellaneous metalwork as shown on the Drawings or specified herein; including, but not limited to, the following items:

1. Structural members, angles, and fasteners.
2. Anchor bolts and epoxy anchors.
3. Stairs and Railings.

1.02 RELATED SECTIONS

A. Section 01330: Submittal Procedures.

B. Section 05520: Handrails and Railings.

C. Section 05532: Metal Bar Grating and Treads.

D. Section 09961: Coatings for Structural Steel.

1.03 SUBMITTALS

A. Submit shop drawings for each fabricated item.

B. Fabrication drawings showing details of fabrication and demonstrating compliance with specification requirements. Include dimensions, sizes, finishes, fasteners, welds, and materials of construction.

C. For standard manufactured items, submit catalog Work sheets showing illustrated cuts of items to be furnished, including scale details, dimensions, and materials.

D. Reference all construction materials by ASTM designations and grades.

E. Submit detailed placement or erection drawings indicating locations of fabricated items. Reproduction of contract documents will not be accepted for this purpose. Verify all dimensions to ensure proper fit of all fabricated items.

F. Welders' Certificates – Certify welders employed on the Work, verifying AWS qualifications within the previous 12 months.

1.04 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):

a. ASTM A36/A36M – Specification for Carbon Structural Steel.

b. ASTM A53/A53M – Specification for Pipe, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

c. ASTM A143 –Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedures for Detecting Embrittlement.

d. ASTM A153/A153M – Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

e. ASTM A307 – Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

f. ASTM A325 – Specification for High-Strength Bolts for Structural Steel Joints.

g. ASTM A384 – Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.

h. ASTM A385 – Practice for Providing High-Quality Zinc Coatings (Hot-Dip).

i. ASTM A500 – Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

j. ASTM A563 – Specification for Carbon and Alloy Steel Nuts.

k. ASTM A595 – Specification for Steel Tubes, Low-Carbon, Tapered for Structural Use.

l. ASTM F436 – Specification for Hardened Steel Washers.

m. ASTM F593 – Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.

n. ASTM F594 – Specification for Stainless Steel Nuts.

o. ASTM F959 – Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

p. ASTM F1852 – Specifications for “Twist-Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/150 ksi Minimum Tensile Strength.

2. American Institute of Steel Construction (AISC):

a. 2010 Specification for Structural Steel Buildings – Second Printing.

b. 2010 Code of Standard Practice for Steel Buildings and Bridges, (AISC 303-10).

c. Manual of Steel Construction, AISC, Fourteenth Edition.

3. American Welding Society (AWS):

a. AWS D1.1 – Structural Welding Code, Steel

4. OSHA and local safety and building codes, together with applicable federal and local laws.

B. Where these Specifications differ from the requirements of AISC, AWS, or ASTM, the more stringent requirements shall apply.

1.05 INSPECTION AND TESTS

A. The right is reserved to reject any material at any time before final acceptance if the ENGINEER finds material and/or workmanship that do not conform to specification requirements. Acceptance of any material shall not prevent its rejection later if defects are discovered. Any installed materials which are rejected by the ENGINEER shall be removed and replaced by the CONTRACTOR to the satisfaction of the ENGINEER and at no additional cost to OWNER.

PART 2 PRODUCTS

2.01 STRUCTURAL STEEL

A. Structural steel wide flange shapes shall conform to ASTM A992.

B. Hollow structural steel round shapes shall conform to ASTM A500, Grade B.

C. Structural steel channels, angles, plates, and bars shall conform to ASTM A36.

D. All structural steel shall be coated (see Section 09910) unless specified otherwise.

2.02 STAINLESS-STEEL PLATE AND MEMBERS

A. Except where otherwise specified, stainless steel plate and members shall be Type 304, ASTM A167.

2.03 THREADED FASTENERS AND ANCHORS

A. Structural threaded anchors and bolts shall conform to ASTM A325. Connections shall be bearing-type connections, unless specified otherwise. Riveted fasteners will not be allowed. Structural nuts shall be hexagonal ASTM A563, unless otherwise specified, and compatible in grade and finish with the bolts. Provide washer for each nut and bolt head. Washers shall be of the same material as the nuts.

B. Stainless-steel bolts shall be ASTM F593, Allow Group 1 or 2. Stainless-steel nuts shall be ASTM F594, Alloy Group 1 or 2. Provide washer for each nut and bolt head. Washers shall be of the same material as the nuts.

2.04 EPOXY ANCHORS

A. Conform to the requirements of Section 03620: Non-shrink Grout.

B. Threaded rod for epoxy anchor bolts shall be stainless steel and part of the Hilti HIT-HY 200 Adhesive Anchoring System or ENGINEER approved equal.

C. Nuts shall be ASTM F594, Alloy Group 1 or 2. Provide washer for each nut and bolt head. Washers shall be of the same material as the nuts.

2.05 WELD ELECTRODES

A. Welding electrodes for structural steel shall conform to AWS A5.5. Use electrodes in the E-70 series.

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate all metalwork with adjoining Work for details of attachment, embedment, fittings, etc., for proper clearances and avoidance of conflicts.

B. Take measurements in field, as required, to verify or supplement dimensions shown on Drawings and assume responsibility for fit of new Work to Work in place.

3.02 STORAGE OF MATERIALS

A. Store structural steel, metalwork, and related material, either plain or fabricated, above ground on platforms, skids, or other supports. Keep material free from dirt, grease and other foreign matter and protect from corrosion.

3.03 FABRICATION AND ERECTION

A. Except as otherwise specified, fabricate and erect structural steel and miscellaneous metalwork in conformance with the requirements of the AISC "Manual of Steel Construction."

B. Fabricate structural steel and miscellaneous metal items to straight lines and true curves. Drilling and punching shall not leave burrs or deformations. Continuously weld permanent connections along the entire area of contact. Exposed Work shall have a smooth finish with welds ground smooth. Joints shall have a close fit with corner joints coped or mitered and shall be in true alignment. Unless specifically indicated on the Drawings, there shall not be bends, twists, or open joints in any finished member nor any projecting edges or corners at intersections.

C. Conceal fastenings wherever possible. Built-up parts shall be free of warp. Exposed ends and edges of metal shall be slightly rounded. Bolt holes shall be 1/16-inch in diameter larger than bolt size, unless specified otherwise on the Drawings. Holes shall be cut, drilled or punched at right angles to the surface of the metal, and shall not be made or enlarged by burning. Measure cast-in-place bolt locations in the field before drilling companion holes.

D. Surfaces of embedded metalwork to be in contact with concrete shall be cleaned of all rust, dirt, grease, and other foreign substances before placing concrete.

E. Set embedded metalwork accurately in position when concrete is placed and support it rigidly to prevent displacement or undue vibration during or after the placement of concrete.

3.04 BOLTING

A. Installation and tightening of structural bolts shall be in accordance with the AISC "Specification for Structural Joints using ASTM A325 or A 490 Bolts."

B. All bolted connections shall be in conformance with applicable provisions of the AISC "Manual of Steel Construction."

C. Preset anchor bolts and expansion anchors by the use of templates. After anchor bolts have been embedded, protect their threads by applying grease and by

having the nuts screwed on until the time of installation of the equipment or metalwork.

3.05 WELDING

A. All welding shall be by the shielded metal-arc method, the submerged-arc method, or the gas-shielded arc method, as described in the AWS "Welding Handbook" and supplemented by other pertinent standards of the AWS. Qualification of welders shall be in accordance with the AWS standards governing same.

B. In assembly and during welding, the component parts shall be adequately clamped, supported and restrained to minimize distortion and for control of dimensions. Weld reinforcement shall be as specified by the applicable AWS Code. Upon completion of welding, remove all weld splatter, flux, slag and burrs. Welds shall be repaired to produce a workmanlike appearance, with uniform weld contours and dimensions. All sharp corners of material to be painted or coated shall be ground to a minimum of 1/32-inch on the flat.

3.06 CONTROL OF FLAME CUTTING

A. Do not use a gas-cutting torch in the field for correcting fabrication errors on any member in structural framing. Use a gas-cutting torch only on minor members when the members are not under stress.

3.07 FINISHES

A. Structural steel or miscellaneous metalwork with damaged surfaces shall be repaired or replaced. Field repairs of surfaces shall be made per Section 09910.

END OF SECTION

SECTION 05310

METAL ROOF DECK

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. Metal Roof Deck
2. Accessories.

B. Related Sections:

1. Section 13120 – Metal Building System

1.03 REFERENCES

A. American National standards institute (ANSI):

1. ANSI/SDI-RD - Standard for Steel Roof Deck.

B. American Welding Society (AWS):

1. AWS D1.3 - Structural Welding Code-Sheet Steel.

C. ASTM International (ASTM):

1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
2. ASTM A1063/A1063M - Standard Specification for Steel Sheet, Twin-Roll Cast, Zinc-Coated (Galvanized) by the Hot-Dip Process.
3. ASTM A 1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
4. ASTM A 1039/A1039M - Standard Specification for Steel, Sheet, Hot Rolled, Carbon, Commercial, Structural, and High-Strength Low-Alloy, Produced by Twin-Roll Casting Process.
5. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
6. ASTM C1513 - Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
7. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
8. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

9. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests.

D. FM Global (FM):

1. FM - Approval Guide, Building Materials.
2. FM 4451 - Approval Standard for Class 1 Insulated Steel Roof Decks.

E. International building Code (IBC):

1. IBC 1704 - Structural Tests and Special Inspections.
2. IBC 1705 - Statement of special inspections.

F. Underwriters Laboratories (UL).

1.04 INFORMATIONAL SUBMITTALS

A. Product Data: For each type of decking specified, including dimensions, components, profiles, and finishes.

B. Shop Drawings: Layout of decks, anchoring, reinforcing, openings, joints, accessories, and attachments details.

C. Manufacturer Certificates: For each product, from manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: All primary products specified in this section shall be supplied by a single manufacturer with a minimum of ten years' experience in the manufacture of steel deck.

1. Manufacturer offering deck products must be a member of the Steel Deck Institute.

B. Installer Qualifications: Minimum two years' experience installing similar products.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's unopened packaging bearing the brand name and manufacturer's identification until ready for installation.

B. Store products in clean, dry, sheltered area off the ground until ready for use.

C. Protect products from exposure to direct sunlight and rain.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Characteristics: Calculated per AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

B. Fire-Resistance Ratings per ASTM E 119 or UL 263.

C. Factory Mutual Approval Ratings per FM Standard 4451 for Class 1 fire and Class 1-90 windstorm ratings.

2.02 ROOF DECKS; STEEL

A. Profile: Type B. Grade 50 steel.

1. Sidelap: By metal building supplier.

2. Structural roof deck, providing vertical load and diaphragm shear capacity. The wide rib profile is ideal to uniformly support roofing systems applied on top of deck. Typically used for span conditions of 10 feet (3048 mm) or less.

a. Rib Depth: 1.5 inch (38 mm).

b. Width: 36 inches (914 mm).

c. Edges: Male and female, creating an interlocking side lap when installed.

3. Standards Compliance:

a. ASTM A653 SS GR50 minimum.

1) Zinc Coating: G60 or G90.

b. ASTM A1008 SS GR50 minimum.

c. IAPMO UES ER-2018.

d. UL and FM listed.

e. ANSI/SDI RD-2017.

4. Standard Lengths: 6 to 40 ft (1829 mm to 12192 mm).

5. Thickness: By metal building supplier.

2.03 SIDELAP ATTACHMENT

A. VSC2 connection made on interlocking deck sidelaps with the Vulcraft/Verco Group PunchLok II Tool at spacing designated on the approved installation drawings.

B. Self-Drilling Corrosion Resistant Hex Washer Head Screws: Deck may be installed with short leg on the top or underside. The minimum edge distance for screw must be 1-1/2 times the shank diameter of the screw.

C. Arc Seam Welds

D. Fillet Welds

2.04 DECK ATTACHMENT

A. Deck attachment pattern will be per metal building supplier. Attachment pattern will provide sufficient strength to resist shear due to lateral loading and wind uplift.

1. Hilti Fasteners

2. Pneutek Fasteners

3. Self-Drilling Screws compliant with ASTM C1513

4. Welding

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not install roof deck until supporting construction is in place.

B. Examine support framing and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work of this section.

C. If supporting construction is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Verify that surfaces to receive roof deck are free of debris.

B. Place deck in accordance with approved installation drawings.

C. Locate deck bundles to prevent overloading of support members.

3.03 INSTALLATION

A. Install and fasten deck and accessories in accordance with the Contract Documents, approved installation drawings, manufacturer's documented instructions and requirements of ANSI/SDI-RD or ANSI/SDI C as applicable.

1. Welds shall comply with AWS D1.3.

B. Place deck panels on structural supports and adjust to final position with ends aligned. Attach firmly to the supports immediately after placement in order to form a safe working platform.

C. Cut and neatly fit and reinforce deck units and accessories around openings and other work projecting through or adjacent to the decking as shown on the construction drawings.

D. End Bearing: Install deck ends over supports with a minimum end bearing as shown on the installation drawings.

E. Deck End Laps: Where specified on the plans install deck end laps as shown on the installation drawings.

F. Side Closures: Fasten to supporting structure and deck in accordance with the Contract Documents, approved installation drawings, and requirements of ANSI/SDI RD or ANSI/SDI C as applicable.

G. Ridge and valley plates, flat plates at changes of deck direction and sump pans, if required shall be fastened to the deck in accordance with the Contract Documents, approved installation drawings and requirements of ANSI/SDI RD or ANSI/SDI C as applicable.

H. Reinforce steel deck openings per contract documents and approved shop drawings.

I. Trades that subsequently cut unscheduled openings through the deck are responsible for reinforcing the openings.

J. Acoustical Batt Insulation: Supplied by the deck manufacturer and installed by the roofing contractor prior to installation of roof insulation.

3.04 FIELD QUALITY CONTROL

A. Do not use deck units as a working platform or storage area until units are in position and permanently attached to the structure.

B. Construction loads must not exceed load carrying capacity of the deck.

3.05 INSPECTION AND REPAIR

A. Before roof insulation placement, the deck shall be inspected for tears, dents, or other damage that will affect structural performance.

B. Inspections:

1. In accordance IBC 1705.2.2, 2015.

3.06 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 05520

HANDRAILS AND RAILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Work Included: This section includes all labor and materials necessary to install the handrail system as shown on the drawings.

B. Related sections and divisions:

1. Applicable provisions of the General Conditions shall govern the work in this Section.

2. Section 01330 – Submittals.

1.02 QUALITY ASSURANCE

A. Railings shall meet ADA standards where applicable.

B. Railings shall meet OSHA safety standards where applicable.

C. Railings shall meet local or state code standards.

1.03 REFERENCE STANDARDS

A. American Society for Testing and Material (ASTM)

B. Occupational Safety and Health Administration (OSHA)

C. Americans for Disabilities Act (ADA)

D. National Association of Architectural Metal Manufacturer (NAAMM)

1. Metal Finishes Manual

1.04 SUBMITTALS

A. Shop Drawings:

1. Layout, unit dimensions and sections, fastener and weld types, and locations.

B. Product Data:

1. Manufacturer’s literature.

C. Submit in accordance with Section 01330.

1.05 PRODUCT DELIVERY

A. Store to avoid damage.

B. Replace damaged or deteriorated materials and remove from site.

PART 2 PRODUCTS

2.01 STEEL RAILINGS

A. Rails and Posts: A36 or A53

B. Connections and Toe Boards: A36 or premanufactured

C. Bolts and Expansion Bolts: 304 stainless steel

D. Finish: Galvanized

PART 3 EXECUTION

3.01 RAILING REQUIREMENTS

A. Provide number of rails as indicated on the drawings.

1. Rail Height:

a. Floor to Top Rail: 42 inches

b. Nose of Stair Tread to Top of Rail: 36 inches

B. Nominal Rail Size:

1. Pipe: 1-1/2 inch O.D. x 5/32-inch minimum wall thickness round mechanical tubing.

C. Design to withstand 200-pound load in any direction at any point on railing.

D. Design to support control panel(s) as needed

E. Provide drainage outlets for moisture:

1. Side mount railings shall have open bottom posts.

2. Top mount railings shall have weep holes at lowest point of posts.

F. Provide handrails and railings with a minimum clearance of not less than 1-1/2 inches between the handrail or railing and any other object.

3.02 FABRICATION

A. Railings shall have one of the following joints:

1. Welded and ground to match the finish specified.

2. Welded on the inside with machine fitted joints.

B. Railing connections shall have a smooth surface with no projections.

C. Provide toe boards when detailed on the drawings or when railings are installed over areas where:

1. Persons can pass.

2. Machinery is moving.

3. Equipment is susceptible to falling material.

4. Local codes govern

D. Make bends without fittings.

E. Cut joints square, clean, and accurate, maintaining minimum gap.

F. Make pipe joints by coping pipe.

G. Welded shop and field joints shall be continuously welded.

3.03 ERECTION

A. Post Spacing: Spacing sha11 be uniform, 4’-0” feet maximum.

B. Handrail Bracket Spacing: 6’ -0” inch maximum.

C. Tighten mountings and fasteners so complete railing is rigid and there is no movement.

D. Install concealed type expansion joints in top rail at 24’-0” inch maximum spacing.

E. Paint surfaces of components in contact with other materials that are corrosive, dissimilar metals, etc., and permanently exposed to moisture with a protective coating.

F. Protect finish from scratches, nicks, gouges, dents, and other damage during storage, assembly, and installation. Leave plastic film intact on pipe until inspection and acceptance by Owner.

END OF SECTION

SECTION 05532

METAL BAR GRATING AND TREADS

PART 1 GENERAL

1.01 SUBMITTALS

A. Shop Drawings:

1. Grating layout, unit dimensions and sections, fastener and weld types, and locations.

B. Product Data:

1. Manufacturer's literature.

C. Submit in accordance with Section 01330.

1.02 QUALITY ASSURANCE

A. All Grating shall be end products of one manufacturer to achieve standardization for appearance and replacement.

B. Treads shall meet ADA standards where applicable.

C. Treads shall meet OSHA safety standards where applicable.

D. Treads shall meet local or state code standards.

1.03 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM)
2. OSHA and local safety and building codes, together with applicable federal and local laws.
3. Americans for Disabilities Act (ADA)
4. National Association of Architectural Metal Manufacturer (NAAMM)

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store to avoid damage.

B. Replace damaged or deteriorated materials and remove from site.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide shop-fabricated grating in accordance with latest edition of Metal Bar Grating Manual.

B. Grating shall be steel.

C. Provide accessories such as frames, support angles, and fasteners to complete Work.

D. Provide fastening devices for gratings to firmly anchor grating to supports. Minimum of 4 per panel.

E. Devices fasten sections of grating shall allow for repeated removal of grating.

F. Fasteners for anchoring grating shall be saddle clip type, "G" clip type, or grating clamp type with minimum 1/4in. bolts and nuts or self-tapping screws. Fasteners shall be stainless steel.

G. Provide trim banding or load carrying banding on edges and cutouts. Bearing bar ends not resting on support shall have load carrying banding seized to span opening. Minimum banding thickness shall match bearing bars. Banding shall be flush with top of grating. Banding depth shall be ¼ in. less than depth of bearing bar. Weld banding to grating in accordance with NAAMM requirements.

H. Cross bars shall not project more than 1/8 in. past bearing bars on panel edges.

I. Panels shall have minimum bearing equal to depth of bearing bar, but not less than 1 in., including removable panels after being offset between support angles or other restraints.

J. Minimum width of individual grating panels shall be 15 in. except for locations requiring single piece and for designated removable sections. Maximum width shall be 4 ft 0 in.

2.02 STEEL GRATING

A. Materials:

1. Pressure locked grating (swagged type).

2. Grating bearing bars shall be at 1-3/16 in. centers with cross-bars at 4 in.

2.03 GRATING SUPPORTS

A. Provide steel support angles as called for on the plans. Angles shall be at minimum 3"x3"x ¼-inch thick.

B. Provide support angles, channels and beams as noted bolted to concrete and masonry with concrete anchors as noted.

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate all grating with with adjoining Work for details of attachment, embedment, fittings, etc., for proper clearances and avoidance of conflicts.

3.02 TREAD REQUIRMENTS

A. Treads shall have a uniform rise and run over the entire length of the staircase.

B. Design to withstand 300-pound vertical load at any location or 100 pounds per square foot.

3.03 ERECTION

A. Install in accordance with approved submittals and manufacturer's written instructions.

B. Maximum Clearances:

1. ¼ in. from vertical metal sections.
2. ½ in. from concrete walls.
3. ¼ in. between sections and at ends.

3.04 EXAMINATION

A. Examine surfaces to receive grating and notify ENGINEER of deficiencies resulting in improper installation.

END OF SECTION

SECTION 07210

RIGID INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building Insulation for sheathing and underlayment applications.

B. Building Insulation for concrete and masonry wall applications.

C. Building Insulation for cavity wall applications.

D. Building Insulation for underslab applications.

E. Building Insulation for below grade applications.

1.02 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

B. ASTM C203 - Standard Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.

C. ASTM C272 - Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.

D. ASTM C303 - Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.

E. ASTM C518 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

F. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.

G. ASTM D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

H. ASTM D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

J. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.

K. US Green Building Council.

1.03 SUBMITTALS

A. See Section 01330 – Submittal Procedures.

B. Product Data: Provide data on material characteristics.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum of 5 years documented experience in the manufacture of products specified.

B. Installer Qualifications: Installer shall be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

1.05 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.06 WARRANTY

A. Installation Warranty: Provide installer's 2 year warranty from date of Preliminary Acceptance, including all components of the air and vapor barrier assembly, against failures including loss of air tight seal, loss of watertight seal, loss of adhesion, loss of cohesion, and failure to cure properly.

PART 2 PRODUCTS

2.01 EPS BUILDING INSULATION

A. Unfaced Flat Board Stock: Foam rigid, closed cell, expanded polystyrene (EPS) boards, UL certified, complying with ASTM C 578:

1. Size: Largest practical size for project.

2. Thickness: See project drawings

3. Insect/Mold Resistant: Provide with insect and mold resistant treatments.

4. Physical Properties, Unfaced:

a. Nominal Density (pcf): 1.0 as tested in accordance with ÅSTM C 303.

b. C-Value (Conductance) BTU/(hr/ft2/degrees F) per inch as tested in accordance with ÅSTM C 518 or ÅSTM C 177.

1) C .230 @ 25 degrees.

2) C .240 @ 40 degrees.

3) C .260 @ 75 degrees.

c. R-Value Thermal Resistance (hr/ft2/degrees F) /BTU per inch as tested in accordance with ASTM C 518 or ASTM C 177

1) R 4.35 @ 25 degrees.

2) R 4.17 @ 40 degrees.

3) R 3.85 @ 75 degrees.

d. Compressive Strength, ÅSTM D 1621: Minimum 10 psi.

e. Flexural Strength, ÅSTM C 203: Minimum 25 psi.

f. Dimensional Stability, ASTM D 2126: Maximum 2 percent.

g. Water Vapor Permeance, ASTM E 96: Maximum 5.0 perms.

h. Water Absorption, ÅSTM C 272: Maximum 4.0 percent.

i. Capillarity: None.

j. Flame Spread as tested in accordance with ÅSTM E 84: Less than 20.

k. Smoke Developed as tested in accordance with ASTM E 84: 150 to 300.

5. Manufacturers:

a. Carlisle Coatings and Waterproofing.

2.02 ACCESSORIES

A. Adhesive: Material and type compatible with EPS insulation board and acceptable to EPS insulation board manufacturer.

B. Wall Ties: Material and type compatible with EPS insulation board and acceptable to EPS insulation board manufacturer.

C. Mechanical Fasteners: Material and type compatible with EPS insulation board and acceptable to EPS insulation board manufacturer.

D. Furring Channels: Material and type compatible with EPS insulation board and acceptable to EPS insulation board manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION/APPLICATION

A. Install in accordance with manufacturer's instructions.

B. Install faced insulation with the facing on the side recommended by the manufacturer.

C. Insulation Board Joints: Stagger EPS insulation board joints in one direction for each course. Butt edges and ends tightly to adjacent EPS boards.

D. Interior Wall Sheathing Installation: On exterior side of stud framing, install EPS insulation board vertically or horizontally as required. Fasten vertically 12 inches

(300 mm) maximum on centers using fasteners recommended by manufacturer. On interior side of stud framing, install a minimum of 1/2 inch (12.7 mm) thick gypsum wallboard over EPS board.

E. Interior Concrete and Masonry Walls: Install EPS insulation board directly to concrete and unit masonry substrates.

1. Remove jagged surfaces or surface irregularities prior to installation.
2. Attach insulation by using polystyrene compatible adhesive or an approved mechanical fastener.
3. Butt edges tightly.
4. Mechanically attach furring strips through the insulation and into the wall substrate with approved using fasteners recommended by manufacturer.
5. On interior side of the wall, install a minimum of 1/2 inch (12.7 mm) thick gypsum wallboard over EPS board.

F. Cavity Walls: Install EPS insulation board on exterior surface of interior wythe of cavity wall, fitting board between wall ties and other projections and penetrations without large gaps or openings.

1. Remove jagged surfaces or surface irregularities prior to installation.
2. Attach insulation in conformance with the applicable code.
3. Maintain installed insulation to a point above the outer wythe as the work progresses to keep mortar from blocking the cavity.
4. Maintain a space between the insulation and the inside face of the outer wythe of at least 3/4 inch.
5. Stagger multiple layers of insulation. Butt edges tightly.
6. Tape all horizontal and vertical joints in the insulation with PolyGard 136 tape.

G. Protection Board and Perimeter Foundation Insulation: Install EPS insulation board on exterior surface of perimeter foundation walls.

1. Remove jagged surfaces or surface irregularities prior to installation.
2. Verify that damproofing or waterproofing is fully cured prior to application over such surfaces.
3. Attach insulation by pressing into cured damproofing or waterproofing or by using polystyrene compatible adhesive.
4. Butt edges tightly.
5. Apply polystyrene compatible sealant to the joint between the substrate and the insulation board to minimize water infiltration behind the insulation.
6. Do not allow ESP insulation to be exposed for an extended period of time to protect from UV exposure and damage from other trades.
7. Carefully backfill without displacing or damaging the insulation board.

H. Under Slab-On-Grade: Install EPS insulation board under slab-on-grade and over properly prepared subgrade of compacted fill and vapor retarder. Place EPS board with sides and ends butted.

1. Prepare subgrade by removing surface irregularities prior to installation.
2. Install vapor barrier over subgrade to protect against dampness and moisture penetration.
3. If under slab waterproofing is indicated on the Drawings verify that it is fully cured prior to application.
4. For vertical surfaces attach insulation by pressing into cured damproofing or waterproofing or by using polystyrene compatible adhesive.
5. Butt edges tightly.
6. For the top edge of vertical surfaces apply polystyrene compatible sealant to the joint between the substrate and the insulation board to minimize water infiltration behind the insulation.
7. Do not allow ESP insulation to be exposed for an extended period of time to protect from UV exposure and damage from other trades.
8. Carefully install reinforcing and concrete without displacing or damaging the insulation board.

3.04 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 07410

INSULATED METAL PANELS

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. Foamed-insulation-core metal wall panels.
2. Foamed-insulation-core metal roof panels.
3. Accessories.

B. Related Sections:

1. Section 13120 – Metal Building Systems

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.05 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.06 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical metal panel assembly, including corner, supports, attachments, and accessories.

2. Water-Spray Test: Conduct water-spray test of metal panel assembly mockup, testing for water penetration according to AAMA 501.2.

3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Engineer specifically approves such deviations in writing.

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering.

C. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

1.08 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

B. Coordinate metal panel installation with reinforced concrete knee wall, as shown on the Drawings.

C. Coordinate metal panel installation with required rough openings for doors and louvers, with sizes and locations as shown on the Drawings.

D. Coordinate metal panel installation with metal building framing.

1.09 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.

b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 72:

1. Wind Loads: As indicated in Specification Section 13120, Metal Building Systems.

2. Other Design Loads: As indicated in Specification Section 13120, Metal Building Systems.

3. Deflection Limits: For wind loads, no greater than 1/240 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Test-Response Characteristics: Provide metal panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and

inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E 119.
2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested according to NFPA 268.
4. Potential Heat: Acceptable level when tested according to NFPA 259.
5. Surface-Burning Characteristics: Provide panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E 84.

2.02 FOAMED-INSULATION-CORE METAL PANELS

A. General: Provide factory-formed and -assembled metal panels fabricated from two metal facing sheets and insulation core foamed in place during fabrication, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

1. Panel Performance:
   a. Flatwise Tensile Strength: 30 psi when tested according to ASTM C 297/C 297M.
   b. Humid Aging: Volume increase not greater than 6.0 percent and no delamination or metal corrosion when tested for seven days at 140 deg F and 100 percent relative humidity according to ASTM D 2126.
   c. Heat Aging: Volume increase not greater than 2.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at 200 deg F according to ASTM D 2126.
   d. Cold Aging: Volume decrease not more than 1.0 percent and no delamination, surface blistering, or permanent bowing when tested for seven days at minus 20 deg F according to ASTM D 2126.
   e. Fatigue: No evidence of delamination, core cracking, or permanent bowing when tested to a 20-lbf/sq. ft. positive and negative wind load and with deflection of L/180 for 2 million cycles.
   f. Autoclave: No delamination when exposed to 2-psi pressure at a temperature of 212 deg F for 2-1/2 hours.
2. Insulation Core: Modified isocyanurate or polyurethane foam using a non-CFC blowing agent, with maximum flame-spread and smoke-developed indexes of 25 and 450, respectively.
   a. Closed-Cell Content: 90 percent when tested according to ASTM D 6226.
   b. Density: 2.0 to 2.6 lb/cu. ft. when tested according to ASTM D 1622.
   c. Compressive Strength: Minimum 20 psi when tested according to ASTM D 1621.

d. Shear Strength: 26 psi when tested according to ASTM C 273/C 273M.

B. PANEL TYPE: Concealed-Fastener, Foamed-Insulation-Core Metal Panels: Formed with tongue-and-groove panel edges; designed for sequential installation by interlocking panel edges and mechanically attaching panels to supports using concealed clips or fasteners.

1. Basis-of-Design Product: Subject to compliance with requirements, provide Metl-Span CF Fluted insulated metal panels as manufactured by Metl-Span, 1720 Lakepoint Drive, Suite # 101, Lewisville, Texas, 75057 or comparable product by one of the following:

a. CENTRIA Architectural Systems.

b. Kingspan

c. Others as approved BEFORE bidding.

2. Metallic-Coated Steel Sheet: Facings of zinc-coated (galvanized) steel sheet complying with ASTM A 653/A 653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A 792/A 792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A 755/A 755M.

a. Exterior Facings: Stucco Embossed, G-90 galvanized and/or AZ-50 aluminum-zinc coated steel with nominal thickness of 0.022 inch.

1) Exterior Finish: Two-coat fluoropolymer

2) Color: As selected by Owner from manufacturer's full range of standard colors.

b. Interior Facings: Stucco Embossed, G-90 galvanized and/or AZ-50 aluminum-zinc coated steel with nominal thickness of 0.022 inch.

1) Interior Finish: Siliconized polyester.

2) Color: As selected by Owner from manufacturer's full range of standard colors.

3. Panel Coverage: 42 inches nominal.

4. Panel Thickness:

a. Wall Panels: 4.0 inches

b. Roof Panels: 6.0 inches

5. Panel Length: 25 feet nominal as indicated on the drawings.

6. Thermal-Resistance Value (R-Value): 7.2 per inch according to ASTM C 1363.

2.03 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.

2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.

3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.04 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal panel manufacturer for application but not less than thickness of metal being secured.

2.05 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
2. Siliconized Polyester: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil for primer and 0.8 mil for topcoat.
3. Concealed Finish: Apply pretreatment and manufacturer's standard white or light-colored acrylic or polyester backer finish consisting of prime coat and wash coat with a minimum total dry film thickness of 0.5 mil.

PART 3 EXECUTION

3.01 DELIVERY TO SITE

A. Supplier shall be responsible for scheduling of delivery and delivery to the site in accordance with the Schedule and Milestone dates specified in Section 01010 Project Summary and Work Sequence.

B. The protection of the shipped items shall be the responsibility of the Building Procurement Contractor. Any damaged items will not be accepted and shall be replaced by the Building Procurement Contractor at no additional expense to the Owner.

END OF SECTION

SECTION 07490

INSULATION PROTECTION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rigid insulation protection

B. Related Sections:

1. Section 07210 Rigid Insulation

1.02 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Protection Board:

1. Material: Fiberglass reinforced plastic.
2. Thickness: 0.060 inch nominal.
3. Color: Neutral light/medium gray.
4. Panel Height: Cover insulation without horizontal seams.
5. Acceptable Manufacturers:
   a. Ground Breaker by Nudo Products

B. Trim:

1. Material: Extruded vinyl.
2. Color: Match panel color.
3. Pieces: Cap, outside corner, inside corner, and divider.
4. Manufacturer: by panel manufacturer.

C. Accessories:

1. Adhesive: As recommended by manufacturer.
2. Rivets: Nylon drive rivets, color to match panel color

PART 3 EXECUTION

2.02 INSTALLATION

A. Layout panels to minimize intermediate joints.

B. Adhere the panel with adhesive to the foundation insulation as recommended by panel manufacturer.

C. Top edge of the panel shall be installed so that it will be secured behind exterior building wall cladding.

D. Rivets shall be used at the top edge of the panel where they will be concealed after installation.

E. Attach exposed trim with rivets and concealed trim with rivets or adhesive.

END OF SECTION

SECTION 08110

HOLLOW METAL DOORS AND FRAMES

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 hollow-metal work.

B. Related Requirements:

1. Section 08710 "Door Hardware"

1.03 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM- HMMA 803 or SDI A250.8.

1.04 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.05 SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.

B. Shop Drawings: Include the following:

1. Elevations of each door type.
2. Details of doors, including vertical- and horizontal-edge details, metal thicknesses, and glass.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of each different wall opening condition.
6. Details of anchorages, joints, field splices, and connections.
7. Details of accessories.
8. Details of moldings, removable stops, and glazing.
9. Details of conduit and preparations for power, signal, and control systems.

C. Samples for Initial Selection: For units with factory-applied color finishes.

D. Samples for Verification:

E. For each type of exposed finish required, prepared on Samples of not less than 3 by 5 inches (75 by 127 mm).

F. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.

1.06 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use non-vented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door Products; an Assa Abloy Group company.
2. Curries Company; an Assa Abloy Group company.
3. Deansteel.
4. Republic Doors and Frames.
5. Steelcraft; an Ingersoll-Rand company.
6. Others as approved BEFORE bidding.

B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 REGULATORY REQUIREMENTS

A. Fire-Rated Assemblies: Complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

1. Smoke- and Draft-Control Assemblies: Provide an assembly with gaskets listed and labeled for smoke and draft control by a qualified testing agency acceptable

to authorities having jurisdiction, based on testing according to UL 1784 and installed in compliance with NFPA 105.

B. Fire-Rated, Borrowed-Light Assemblies: Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing according to NFPA 257 or UL 9.

2.03 INTERIOR DOORS AND FRAMES

A. Construct interior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, glass, hardware reinforcement, tolerances, and clearances, and as specified.

2.04 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

2.05 FRAME ANCHORS

A. Jamb Anchors:

1. Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0 mm) thick.

2. Postinstalled Expansion Type for In-Place Concrete or Masonry: Minimum 3/8-inch- (9.5-mm-) diameter bolts with expansion shields or inserts. Provide pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.

B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

2. Separate Topping Concrete Slabs: Adjustable-type anchors with extension clips, allowing not less than 2-inch (51-mm) height adjustment. Terminate bottom of frames at finish floor surface.

2.06 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.

D. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.

E. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

F. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow- metal frames of type indicated.

G. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

H. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

I. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15-mil (0.4-mm) dry film thickness per coat. Provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.

2.07 FABRICATION

A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.

B. Hollow-Metal Doors:

1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.

2. Fire Door Cores: As required to provide fire-protection and temperature-rise ratings indicated.

3. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.

4. Top Edge Closures: Close top edges of doors with inverted closures, except provide flush closures at exterior doors] of same material as face sheets.

5. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.

6. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.

C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
4. Jamb Anchors: Provide number and spacing of anchors as follows:
    a. Stud-Wall Type: Locate anchors not more than 18 inches (457 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c. and as follows:
        1) Three anchors per jamb up to 60 inches (1524 mm) high.
        2) Four anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
        3) Five anchors per jamb from 90 to 96 inches (2286 to 2438 mm) high.
        4) Five anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 96 inches (2438 mm) high.
    b. Compression Type: Not less than two anchors in each frame.
    c. Postinstalled Expansion Type: Locate anchors not more than 6 inches (152 mm) from top and bottom of frame. Space anchors not more than 26 inches (660 mm) o.c.
5. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
6. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
    b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.
7. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 45-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.

E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.

F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.

1. Single Glazed Lites: Provide fixed stops and moldings welded on secure side of hollow-metal work.

2. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

3. Provide loose stops and moldings on inside of hollow-metal work.

4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

2.08 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.

1. Color and Gloss: As selected by Owner from manufacturer's full range of colors and gloss.

2.09 GLAZING

A. General

1. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

a. NGA Publications: "Glazing Manual."

b. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

2. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

3. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass. Where fully tempered float glass is indicated, provide fully tempered float glass.

B. Glazing Products

1. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

2. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

3. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

a. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

C. Insulating Glass

1. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

a. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.

2.10 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

PART 3 EXECUTION

3.01 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 embedded and built-in anchors to verify actual locations before frame installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.03 INSTALLATION

A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.

B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.

a. At fire-rated openings, install frames according to NFPA 80.

b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.

c. Install frames with removable stops located on secure side of opening.

d. Install door silencers in frames before grouting.

e. Remove temporary braces necessary for installation only after frames have been properly set and secured.

f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.

g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.

2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.

4. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.

5. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:

a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.

b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.

c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.

d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.

C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Steel Doors:
    a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
    b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
    c. At Bottom of Door: 1/2 inch (12.7 mm) plus or minus 1/32 inch (0.8 mm).
    d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
3. Smoke-Control Doors: Install doors and gaskets according to NFPA 105.

3.04 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.

B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

C. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

D. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.

E. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08120

METAL ROLLING DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Insulated rolling service doors.

1.02 REFERENCES

A. ANSI/DASMA 108 - American National Standards Institute Standard Method For Testing Sectional Garage Doors And Rolling Doors: Determination Of Structural Performance Under Uniform Static Air Pressure Difference.

B. NFRC 102 - Test Procedure for Measuring the Steady-State Thermal Transmittance of Fenestration Systems.

C. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Element.

D. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

E. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

F. ASTM A666 - Standard Specification for Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

G. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

J. NEMA MG 1 - Motors and Generators.

1.03 DESIGN/PERFORMANCE REQUIREMENTS

A. 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.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories, Inc. acceptable to authority having jurisdiction as suitable for purpose specified.

1.04 SUBMITTALS

A. Submit under provisions of Section 01330.

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. Selection Samples: For each finish product specified, two complete sets of color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, two samples, minimum size 6 inches (150 mm) long, representing actual product, color, and patterns.

F. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

G. Operation and Maintenance Data: Submit lubrication requirements and frequency, and periodic adjustments required.

1.05 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: Installer Qualifications: Company specializing in performing Work of this section with minimum three years and approved by manufacturer.

1.06 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.

1.07 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.

1.08 COORDINATION

A. Coordinate Work with other operations and installation of adjacent materials to avoid damage to installed materials.

1.09 WARRANTY

A. Warranty: Manufacturer's limited door system warranty for 2 years for all parts, components, and finishes.

PART 2 PRODUCTS

2.01 INSULATED ROLLING SERVICE DOORS

A. Insulated Rolling Service Doors:

1. Curtain: Interlocking roll-formed slats as specified following. Endlocks shall be attached to each end of alternate slats to prevent lateral movement.
    a. Flat profile type
    b. Front slat fabricated of:
        1) 24-gauge galvanized steel.
    c. Back slat fabricated of:
        1) 24-gauge galvanized steel.
    d. Slat cavity filled with CFC-free foamed-in-place, polyurethane insulation.
        1) R-Value: 7.7, U-Value: 0.13.
        2) Sound Rating: STC-21.
2. Performance:
    a. Through Curtain Sound Rating: Sound Rating: STC-28 (STC-30+ with HZ noise generator) as per ASTM E 90.
    b. Installed System Sound Rating: STC-21 as per ASTM E 90.
    c. U-factor: 0.91 NFRC test report, maximum U-factor of no higher than 1.00.
    d. Air Infiltration: Meets ASHRAE 90.1 & IECC 2012/2015 C402.4.3 Air leakage <1.00 cfm/ft2.
3. Slats and Hood Finish:
    a. Galvanized Steel: Slats and hood galvanized in accordance with ASTM A653 and receive rust-inhibitive, roll coating process, including 0.2 mils thick baked-on prime paint, and 0.6 mils thick baked-on polyester topcoat.
4. Weatherseals:
    a. Vinyl bottom seal, exterior guide and internal hood seals.
    b. Interior guide weatherseal.
    c. Lintel weatherseal.
    d. Air Infiltration Package, IECC 2012/2015 listed; product to meet C402.4.3 2012 Air leakage <1.00 cfm/ft2.
        1) Air infiltration perimeter seal package includes: guide cover, guide cap, dual brush exterior guide seal, 4 inch finned lintel brush seal and vinyl bottom seal.

5. Bottom Bar:
    a. Two (2) galvanized steel angles minimum thickness 1/8 inch (3 mm) bolted back to back to reinforce curtain in the guides.
6. Guides: Three (3) structural steel angles.
7. Brackets:
    a. Galvanized steel to support counterbalance, curtain and hood.
8. 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.
9. Hood: Provide with internal hood baffle weatherseal.
    a. 24-gauge galvanized steel with intermediate supports as required.
10. Electric Motor Operation: Provide UL listed electric operator, size 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. Entrapment Protection:
        1) Constant Hold to close to meet UL 325
    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. Special Operation:
    d. Motor Voltage: 115/230 single phase, 60 Hz.
11. Wind Load Design:
    a. See Design Drawings
12. Operation: Design door assembly, including operator, to operate for not less than 20,000 cycles.
13. Locking:
    a. Interior slide bolt lock for electric operation with interlock switch.
14. Wall Mounting Condition:
    a. Face-of-wall mounting.
15. Insulated Vision Lites: Yes, 7’-0” above the door sill.

PART 3 EXECUTION

3.01 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 Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install 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. Complete wiring from disconnect to unit components.

F. Coordinate installation of sealants and backing materials at frame perimeter.

G. Install perimeter trim and closures.

H. Instruct Owner’s personnel in proper operating procedures and maintenance schedule.

3.04 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.

3.05 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.

3.06 PROTECTION

A. Protect installed products until completion of project.

END OF SECTION

SECTION 08710

DOOR HARDWARE

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. Mechanical door hardware for the following:

a. Swinging doors.

B. Related Sections:

1. Section 08110 – Hollow Metal Doors and Frames

1.03 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.

C. Other Action Submittals:

1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

a. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.

b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.

c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

d. Content: Include the following information:

1) Identification number, location, hand, fire rating, size, and material of each door and frame.

2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.

3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.

2. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.04 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:

1. For door hardware, an Architectural Hardware Consultant (AHC)

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.

E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.

1. Air Leakage Rate: Maximum air leakage of0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at the tested pressure differential of 0.3-inch wg (75 Pa) of water.

F. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

G. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf (22.2 N).

2. Comply with the following maximum opening-force requirements:

a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.

b. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.

3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.

4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.

H. Preinstallation Conference: Conduct conference at Project site.

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

2. Inspect and discuss preparatory work performed by other trades.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

1.07 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.08 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including excessive deflection, cracking, or breakage.

b. Faulty operation of doors and door hardware.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five (5) years from date of Substantial Completion, unless otherwise indicated.

a. Exit Devices: Five years from date of Substantial Completion.

b. Manual Closers: 10 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 PRODUCTS

2.01 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled to comply with requirements in this Section.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the door schedule. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements.

2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.02 HINGES

A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Baldwin Hardware Corporation.

b. Hager Companies.

c. IVES Hardware; an Ingersoll-Rand company.

d. Lawrence Hardware Inc.

e. McKinney Products Company; an ASSA ABLOY Group company.

f. Stanley Commercial Hardware; Div. of The Stanley Works.

2.03 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:

1. Bored Locks: Minimum 1/2-inch (13-mm) latchbolt throw.

C. Lock Backset: 2-3/4 inches (70 mm), unless otherwise indicated.

D. Lock Trim:

1. Description: As indicated in Hardware Set.

2. Operating Device: Lever with escutcheons (roses).

E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.

F. Bored Locks: BHMA A156.2; Grade 1; Series 4000.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Best Access Systems; Div. of Stanley Security Solutions, Inc.

b. Corbin Russwin Architectural Hardware; n ASSA ABLOY Group Company.

c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

d. Schlage Commercial Lock Division; an Ingersoll-Rand company.

e. Yale Security Inc.; an ASSA ABLOY Group company.

2.04 EXIT DEVICES

A. Exit Devices: BHMA A156.3.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

b. DORMA Architectural Hardware; Member of The DORMA Group North America.

c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

d. Von Duprin; an Ingersoll-Rand company.

e. Yale Security Inc.; an ASSA ABLOY Group company.

2.05 LOCK CYLINDERS

A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.

1. Manufacturer: Same manufacturer as for locking devices.

B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.

C. Construction Master Keys: Provide cylinders with feature that permits voiding of construction keys without cylinder removal. Provide 10 construction master keys.

D. Construction Cores: Provide construction cores that are replaceable by permanent cores. Provide 10 construction master keys.

2.06 KEYING AND EXTERIOR KEYPAD

A. Match Owner’s keying system.

B. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.

1. Grand Master Key System: Change keys, a master key, and a grand master key operate cylinders.

2. Match Owner’s Keying System. Existing System:

3. Keyed Alike: Key all cylinders to same change key.

C. Keys: Nickel silver

D. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:

1. Notation: "DO NOT DUPLICATE."

E. Quantity: In addition to one extra key blank for each lock, provide the following:

1. Cylinder Change Keys: Three.

2. Master Keys: Five.

3. Grand Master Keys: Five.

F. Keypads

1. Keypad shall be of a vandal resistant, anti-pull-off design with stainless steel construction and have 12 buttons arranged in a standard telephone matrix to be compliant with federal handicap standards.

2. Keypad shall be standard weather resistant without the need for a gasket or a separate weather resistance option.

3. Lockset shall be capable of operating in temperatures from –40° C to +66° C and 95% relative humidity, non-condensing.

4. Keypad shall be capable of performing 3,000,000 cycles minimum.

5. Controlling electronics shall be housed on the interior side of the door for security

6. Lock shall be programmable through the keypad only, without the requirement of a separate electronic device.

7. Locks shall have key over-ride, or non-key over-ride and a 2-wire remote unlock input.

8. Lock shall have over 99 available codes: 1 Master, 1 Emergency, 1 Supervisor, 1 Lockout, 1 Passage and Users.

9. Lockset shall accommodate codes from 2 to 7 digits in length.

10. Lock shall have three LEDs for visual indication: Green-Unlock, Red-Error, Yellow-Pushbutton Acceptance & Programming.

11. All locksets shall not allow full programming until the master and emergency factory codes have been changed for added security.

2.07 ACCESSORIES FOR PAIRS OF DOORS

A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

B. Astragals: BHMA A156.22.

2.08 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company.

b. LCN Closers; an Ingersoll-Rand company.

c. Norton Door Controls; an ASSA ABLOY Group company.

d. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

e. Yale Security Inc.; an ASSA ABLOY Group company.

2.09 MECHANICAL STOPS AND HOLDERS

A. Wall- and Floor-Mounted Stops: BHMA A156.16; aluminum base metal.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Baldwin Hardware Corporation.

b. Hager Companies.

c. IVES Hardware; an Ingersoll-Rand company.

d. Stanley Commercial Hardware; Div. of The Stanley Works.

2.10 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Hager Companies.

b. National Guard Products.

c. Pemko Manufacturing Co.; an ASSA ABLOY Group company.

d. Zero International.

2.11 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Hager Companies.

b. Pemko Manufacturing Co.; an ASSA ABLOY Group company.

c. Zero International.

2.12 METAL PROTECTIVE TRIM UNITS

A. Metal Protective Trim Units: BHMA A156.6; fabricated from 0.050-inch-(1.3-mm-) thick stainless steel; with manufacturer's standard machine or self-tapping screw fasteners.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:

a. Baldwin Hardware Corporation.

b. IVES Hardware; an Ingersoll-Rand company.

c. Rockwood Manufacturing Company.

2.13 FABRICATION

A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Architect.

1. Manufacturer's identification is permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.

C. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Fire-Rated Applications:

a. Machine Screws: For the following:

1) Hinges mortised to doors or frames.

2) Strike plates to frames.

3) Closers to doors and frames.

b. Steel Through Bolts: For the following unless door blocking is provided:

1) Surface hinges to doors.

2) Closers to doors and frames.

3) Surface-mounted exit devices.

3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

4. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

2.14 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.

3.03 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.

1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.

1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.

2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches (750 mm) of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

D. Lock Cylinders: Install construction cores to secure building and areas during construction period.

1. Replace construction cores with permanent cores as directed by Owner.

2. Furnish permanent cores to Owner for installation.

E. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant.

F. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

G. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

H. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.

I. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.04 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

1. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.

3.05 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.06 DOOR HARDWARE SCHEDULE

A. All hardware shall have satin chrome finish – US26D (BHMA 626)

B. General: Provide hardware for each door to comply with requirements of Section "Door Hardware," hardware group numbers indicated in door schedule, and in the following schedule of hardware groups.

1. Hardware groups indicate quantity, item, manufacturer's designation, size, and finish or color, as applicable.

C. Hardware Group No. 1 Exterior Door(s), with Entrance Function Lockset and weather-stripping:

Per Door	
1 ½ Pair Butts	Hager – BB1279 – 4 ½ x 4 ½
1 Each Lockset w/ Keypad	Schlage CO-100 – Offline Lock Lever Design RHO with cylinder
1 Each Closer	LCN-4111
1 Set Weather Stripping	Pemko – 290CPK (Jambs) Pemko – 2891CS (Head)
2 Each Protective (Kick Plate)	Stainless Steel Sheet 0.050" thick 18" high x width of the door minus 1". Install on each side of door.
1 Each Threshold	Pemko – 2005AT
1 Each Floor Stop	Floor Stop – Hager 252F

D. Hardware Group No. 2 Interior Door(s) with Office Function Lockset:

Per Door	
1 ½ Pair Butts	Hager – BB1279 – 4 ½ x 4 ½
1 Each Lockset	Schlage D50 PD – Office Function, Lever Design RHO with cylinder
1 Each Closer	LCN-4111
2 Each Protective (Kick Plate)	Stainless Steel Sheet 0.050" thick 18" high x width of the door minus 1". Install on each side of door.
1 Each Stop	Hager 234W of 252F

E. Hardware Group No. 3 Interior Door(s) with Passage Function Latchset:

Per Door	
1 ½ Pair Butts	Hager – BB1279 – 4 ½ x 4 ½
1 Each Latchset	Schlage D10 S – Passage Function, Level Design RHO
1 Each Closer	LCN-4111
2 Each Protective (Kick Plate)	Stainless Steel Sheet 0.050" thick 18" high x width of the door minus 1". Install on each side of door.
1 Each Stop	Hager 234W of 252F

F. Hardware Group No. 4 Interior Door(s) with Privacy Function Latchset:

Per Door	
1 ½ Pair Butts	Hager – BB1279 – 4 ½ x 4 ½
1 Each Lockset	Schlage D40 S – Privacy Function, Lever Design RHO
1 Each Closer	LCN-4111
2 Each Protective (Kick Plate)	Stainless Steel Sheet 0.050" thick 18" high x width of the door minus 1". Install on each side of door.
1 Each Stop	Hager 234W of 252F

G. Hardware Group No. 5 Exterior Overhead Doors:

All Hardware provided by door manufacturer

END OF SECTION

SECTION 09650

DRY SHAKE CONCRETE HARDENER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Dry shake concrete harder for slab and apron in storage area

B. Supplier is responsible for surface preparation.

1.02 SUBMITTALS

A. Submit Product Data: For each manufactured material and product indicated.

1.03 QUALITY ASSURANCE

A. Concrete Sub-Contractor Qualification: Concrete Sub-Contractor crew responsible for placing and finishing concrete for the interior floor slab, including dry shake floor hardener, shall include a minimum of three (3) crewmembers that are certified by the American Concrete Institute (ACI) as Concrete Flatwork Finishers, or by the American Society of Concrete Contractors (ASCC). Concrete Sub-Contractor shall include in their bid package to the General Contractor, their certification numbers, and sufficient proof of certification.

B. Concrete Sub-Contractor shall further provide evidence of having installed at minimum of (5) projects of similar size and scope incorporating a dry shake floor hardener system similar to the specified system. The Concrete Sub-Contractor's crew proposed for the work specified herein shall have participated in the majority of the referenced projects, and crew foreman and crew shall remain the same for every placement of dry shake floor hardener and through the duration of this project.

PART 2 PRODUCTS

2.01 FLOOR SLAB TREATMENTS

A. Dry Shake Hardener: Material shall be proprietary blend of wear resistant aggregates, plasticizer, and cement binder. Product shall be delivered in original, unopened packaging labeled with the manufacturer's name, product name and lot number. Store materials at job site, off ground, under dry conditions and at temperatures between 60^{o}F and 80^{o}F.

1. Basis of Design: Non-Oxidizing Metallic DIAMOND-PLATE by Euclid Chemical; www.euclidchemical.com

2. Application Rate: 1.5 lbs per square foot minimum

3. Color to be natural

B. Contractor shall ensure enough shake hardener is on-site to complete the placement without interruption

C. Concrete to receive dry shake on hardener

1. Maximum air content of 3 percent.
2. Conform to ACI 301 and be designed to meet 4000 psi compressive strength at 28 days. The mix shall contain the specified water reducing admixture and achieve a W/Cm ratio of 0.53 (max).

2.02 CURING MATERIALS

A. Liquid curing compounds and evaporation retarders applied to dry shake hardeners shall be manufactured by the same manufacturer as dry shake floor hardener.

B. Reactive silicate-based compounds shall not be used as curing treatments.

C. Evaporation Retarder: Spray-applied, waterborne, monomolecular film, to aid in the prevention of rapid moisture loss from shake hardener and/or fresh concrete surfaces during the finishing operations.

2.03 LIQUID FLOOR TREATMENTS

A. Interior Liquid Densifier / Sealer: Silicate / siliconate blend containing at least 24 percent solids by weight 50 percent of which is siliconate. Product shall be by same manufacturer as dry shake hardener.

PART 3 EXECUTION

3.01 INTERIOR FLOOR SLAB FINISH

A. Concrete mix receiving specified dry shake on hardener shall meet the requirements specified herein. Air content of concrete receiving the specified dry shake on hardener shall be 3% or less. Fly ash, micro silica, slag and calcium chloride or admixtures containing more than 0.05 percent chloride ions are not permitted.

B. Ambient Conditions: Apply specified dry shake on hardener at temperatures of between 60°F and 80°F. Conditions such as high winds, low humidity or hot or cold weather require concrete mix changes and adjustments in application and/or finishing procedures. Coordinate with dry shake on hardener manufacturer.

C. In hot, dry and windy conditions, use the specified evaporation retarder to help retain moisture. Ideally, building walls and roof are in-place, protecting concrete from direct environment. If that is not the case, wind screens shall be installed to reduce moisture evaporation during placement of the specified dry shake on hardener.

D. Pre-stack bags of the specified dry shake on hardener in amount required per square foot, at each bay to be placed that day. Document the total number of bags applied on each placement.

E. Calibrated mechanical spreader shall be capable of a first-pass application rate of 8,000 lbs per hour. Prior to concrete placement, the mechanical spreader shall be calibrated by the Concrete Sub-Contractor to ensure accurate and even application of the specified dry shake on hardener. The mechanical spreader must also be re-calibrated every 3000 square feet to ensure continued accuracy. To ensure accuracy, calibration readings shall be taken by the Concrete Sub-Contractor and reported to the Testing Agency, including location of specified dry shake on hardener application at time of calibration reading. Concrete Sub-Contractor is responsible for maintaining the mechanical spreader and ensuring a consistent application rate of specified dry shake on hardener.

F. Dry Shake On Hardener Single Pass Application: Non-colored or natural colored dry shake on hardeners shall be applied in the following manner and in accordance with manufacturers written recommendations.

1. After concrete is hand or mechanically screeded, use a wood or canvas-resin bullfloat to open the surface and to flatten out or remove any imperfections on the surface of the wet slab. Care shall be taken not to "close" the surface of the concrete.

2. Immediately apply the full amount of dry shake on hardener, by calibrated mechanical spreader. Defer initial floating operations until the dry shake on hardener is completely "wetted out", concrete reaches initial set and has stiffened enough to accept the weight of a walk-behind machine equipped with clip on float shoes.

3. Using walk-behind or a ride-on power-trowel with float shoes, dry shake on hardener must be thoroughly worked into the slab. After the shake on hardener has been worked into the concrete and the slab has been given time to further "tighten up", begin final troweling procedures.

4. Highway Straightedge: Once the shake is floated into the surface, a highway straightedge shall be used to achieve the specified flatness tolerances. Highway straightedge operations shall continue before, during and after troweling operations. During highway straightedge operations, care must be taken to retain the shake hardener in the surface of the concrete.

5. Trowel Finish: Concrete Sub-Contractor shall wait to apply the troweled finish until after the bleed water has escaped the freshly placed and floated surface to prevent delamination of specified dry shake on hardener finish. Apply trowel finish using troweling machines with adjustable blades. All finishing blades shall be in new condition and completely clean of any deleterious materials.

6. Finish the slab according to specifications, paying close attention not to burnish the surface. Final finish shall match accepted mockup.

3.02 INTERIOR FLOOR PROTECTION AND CURING

A. Protection: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 305 for hot-weather protection and ACI 306 for cold-weather protection during placing and curing. For concrete placement during hot, dry and windy conditions, Concrete Sub-Contractor shall use the specified evaporation retarder as per manufacturer instructions and wind breaks as necessary to maintain a moist condition and to minimize plastic drying shrinkage cracking at the surface of the freshly placed concrete.

B. Apply specified dissipating resin curing compound in accordance with manufacturer's written instructions immediately after finishing operations when such application will not mar or damage surface.

3.03 LIQUID FLOOR TREATMENT APPLICATION

A. Remove dissipating resin curing compound residue utilizing standard degreasers and mechanical scrubbing equipment.

B. Prior to application, remove curing compounds residue, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.

C. Do not apply to concrete that is less than 28 days' old.

D. Apply liquid densifier sealer at a coverage rate of no less than 225 square feet (21 sq. m) per gallon until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.

3.04 PROTECTION

A. Protect from petroleum stains.

B. Diaper hydraulic equipment used over concrete surfaces.

C. Prohibit vehicles from interior concrete slabs.

D. Prohibit use of pipe-cutting machinery over concrete surfaces.

E. Prohibit placement of steel items on concrete surfaces.

F. Prohibit use of acids or acidic detergents over concrete surfaces.

G. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION

SECTION 09910

COATINGS FOR STRUCTURAL STEEL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Painting of structural supports and building framing.
2. Galvanizing of structural supports and building framing.

B. Supplier is responsible for surface preparation and coatings of structural members. Coating systems are identified in this Section.

1.02 DEFINITIONS

A. Definitions as used in schedules.

1. Coatings: Heavy duty finishes for use on any surfaces, especially surfaces subject to submerged, high moisture, splash or chemical environment.
2. Ambient Conditions:
   a. Chemical: Surface subject to corrosive chemical splash or fumes.
   b. Moist: Surface subject to wet areas such as shower rooms and rooms with open tanks.
   c. Normal: Surface subject to normal temperatures and humidity such as found in offices and corridors.
3. Splash: Surface subject to frequent washing and chemical splash.
4. Submerged P: Surface submerged in potable water plus 1 ft 0 in. above high liquid level.
5. Submerged NP: Surface submerged in nonpotable liquid such as sewage and sludge plus 1 ft 0 in. above high liquid level.

B. First Coat: Field prime, factory prime, or shop prime. When only one coat is required, first coat is finish coat.

C. Second or Third Coats: Successive finish coats applied over first coat.

1.03 SUBMITTALS

A. Product Data:

1. Submit manufacturer’s literature stating application recommendations and generic makeup of each type of coating scheduled.
2. Substitutions: For coatings not specified, provide substitute manufacturer’s literature with specified coating literature for ENGINEER to make proper evaluation.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated for Project.

B. Single-Source Responsibility:

1. Provide coating material produced by same manufacturer for each system. Use only thinners recommended by manufacturer and only within recommended limits.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in original, sealed, unopened packages and containers bearing manufacturer's name. Each container shall have manufacturer's printed label stating type of coating, color of coating, instructions for reducing, and spreading rate.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturer for most sensitive coating, but not less than 55°F.

C. Keep storage area neat and clean and replace or repair damage thereto or to its surroundings.

D. Avoid danger of fire. Deposit cleaning rags and waste materials in metal containers having tight covers or remove from building each night. Provide fire extinguishers of type recommended by coating manufacturer in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvents. Store solvents in safety cans. Give special attention to possible hazards in areas of existing buildings.

E. Empty containers shall have labels canceled and be clearly marked as to use.

F. Upon Substantial Completion, remaining material will become property of Owner. Seal material as required for storage , marked as to contents and shelf life, and store where required by Owner.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Do not apply exterior coating in cold, foggy, damp or rainy weather.

2. Apply no finish in rooms where dust is being generated.

3. Do not apply exterior coating when temperature is lower than 50°F or as required by manufacturer.

4. Maintain interior temperature and relative humidity of space, as recommended by coating manufacturer, 24 hrs before applying and until coating is cured.

B. Protection:

1. Cover materials and surfaces, including floors, adjoining or below Work with clean drop cloths or canvas.

2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace above items or remove protection and clean.

3. Maintain manufacturer's environmental requirements while coating dries.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paint:

1. Sherwin Williams

2.02 MATERIALS

A. Coatings: As specified or otherwise approved.

2.03 COLORS

A. Colors shall be as noted and approved by Owner.

2.04 MIXING AND TINTING

A. Each coat shall be slightly darker than preceding coat, unless otherwise approved.

B. Tint undercoats similar to finish coats.

2.05 GALVANIZING

A. All structural steel unless otherwise indicated on the drawings or in the specifications to be painted shall be cleaned and then hot-dipped galvanized after fabrication.

B. Except where otherwise specified, galvanizing shall be performed after fabrication, including cutting, punching, welding, and drilling, has been completed. Avoid fabrication techniques that could cause distortion or embrittlement of steel items to be hot-dip galvanized. Fabricators shall consult with hot-dip galvanizer regarding potential warpage problems or handling problems during the galvanizing process that may require adjustment of fabrication techniques or design before finalizing shop drawings and beginning fabrication.

C. Fabricate joints in a manner to exclude water or provide weep holes where water may accumulate.

PART 3 EXECUTION

3.01 EXAMINATION

A. If surfaces to be finished cannot be put into proper condition for finishing by customary cleaning, sanding, and puttying operations or if surfaces were improperly primed by others, report defects to ENGINEER, in writing, or assume responsibility and correct unsatisfactory finish resulting from improper surfaces. Commencement of Work indicates acceptance of surfaces.

B. Materials removed and replaced to correct defects due to Work placed on unsuitable surfaces shall be at CONTRACTOR'S expense.

C. Where surface dryness is questioned, test with dampness indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's printed instructions.

3.02 SURFACE PREPARATION AND TOUCH-UP

A. General:

1. Surfaces, including floors shall be clean, dry, and free of loose dirt, dust, and foreign matter before applying coating.
2. Comply with coating manufacturer's recommendations for surface preparation.

B. Ungalvanized Ferrous Metal:

1. General :
   a. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
   b. Prepare welds and adjacent areas to remove undercutting or reverse ridges on weld bead, weld spatter on or adjacent to weld or area to be coated, and sharp peaks or ridges along weld bead. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
   c. Coat surfaces same day prepared. Reprepare surfaces starting to rust before coating.
2. Cleaning Methods:
   a. Workmanship for metal surface preparation as specified shall conform with SSPC specifications as follows :
      1) SP-1: Solvent Cleaning
      2) SP-2: Hand Tool Cleaning
      3) SP-3: Power Tool Cleaning
      4) SP-5: White Metal Blast Cleaning
      5) SP-6: Commercial Blast Cleaning
      6) SP-7: Brush-off Blast Cleaning
      7) SP-8: Pickling
      8) SP-10: Near-White Blast Cleaning
   b. Wherever "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning," or similar words of equal Intent used in Specifications or coating manufacturer's specifications, they shall be understood to refer to applicable SSPC specifications listed above.
   c. Use hand tools to clean areas that cannot be cleaned by power tools.

C. Galvanized Metal:

1. Fabricate joints in a manner to exclude water or provide weep holes where water may accumulate.
2. To minimize surface imperfections (e.g., flux inclusions), materials to be galvanized shall be dipped into a solution of Zinc Ammonium Chloride (pre-flux) immediately prior to galvanizing. The type of galvanizing process utilizing a flux blanket overlaying the molten zinc will not be permitted.

3. Cleaning: Prior to galvanizing, thoroughly clean metal surfaces of all mill scale, rust, dirt, grease, oil, moisture, and other contaminants. Items shall be cleaned by abrasive blasting to white metal in accordance with SSPC-SP5. Weld flux residue, weld splatter, and minor weld defects not removed by abrasive blasting shall be removed by mechanical means. After abrasive blasting and mechanical cleaning, items shall be fluxed and immediately hot dipped.

3.03 APPLICATION

A. General Requirements :

1. Spread evenly and flow on smoothly without runs, lumps or sags.

2. Make edges of coating adjoining other materials or colors sharp and clean without overlapping.

3. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until previous coat has cured as required by manufacturer. Where sanding is required, according to manufacturer's direction, sand between applications to produce smooth, even surface.

4. Finish edges of doors as specified for faces. Apply one coat finish on tops and bottoms of doors after fitting.

5. Term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system's integrity and provide desired protection.

   a. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces.

   b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

   c. Omit first coat on metal surfaces that have been shop-primed and touch-up painted.

6. Manufacturer-Applied Coating Systems:

   a. Repair abraded areas on factory-finished items in accordance with manufacturer's directions.

   b. Blend repaired areas into original finish.

7. Existing Surfaces:

   a. If finish coat will not produce uniform coverage, provide first coat base over existing Work.

   b. Where ceilings or walls scheduled for patching or remodeling, coat entire ceiling or wall in that area.

   c. At altered rooms. Wherever new Work adjoins existing Work, finish new Work to match existing. Apply first coats as specified for new Work on new Work and wash adjacent existing coated surfaces and apply finish coat(s) over entire area.

8. Application Procedures:

   a. Apply coatings by brush, roller, spray, or other applicators according to manufacturer's instructions.

B. Priming and Sealing:

1. Refer to Coating Schedule for specific coating material.

2. Shop:

   a. Shop first coat for ferrous metal shall comply with SSPC guidelines, and as specified in Coating Schedules of this Specification.

   b. Hand or power sand chipped, peeled or abraded first coat and feather edges. Spot coat areas with specified first coat.

   c. Prior to application of finish coats, clean shop-first coat surfaces free of dirt, oil, and grease.

   d. Prepare and prime holdback areas as required for specified coating system.

C. Galvanized Metal:

1. Application: Hot-dip galvanizing shall conform to the following:

   a. ASTM A143: Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel.

   b. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

   c. ASTM A153: Galvanized Coatings on Iron and Steel Hardware

   d. ASTM A384: Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing Steel Assemblies.

   e. ASTM A385: Practice for Providing High Quality Zinc Coatings.

   f. ASTM A942: Galvanizing Coatings on Steel Sheets.

   g. Minimum weight of galvanized coatings shall be two (2) oz. per square foot of surface.

2. All galvanized materials must be inspected for compliance with these specifications and marked with a stamp indicating the name of the galvanizer, the weight of the coating, and the appropriate ASTM number.

3. Areas of galvanizing damaged during fabrication, shipping, erection, or any other time prior to acceptance of the Work shall be prepared and recoated by one of the following methods:

   a. Parts damaged in the shop shall be removed from the site, stripped of existing coating, cleaned and re-galvanized in accordance with ASTM A 123 or A 153, as applicable.

   b. Field or shop repair areas shall be cleaned and recoated with a 2.0 mil coating of zinc allow using meltable zinc-based alloy bars (hot bar process).

1) The damaged area shall be thoroughly cleaned using a wire brush, a light grinding action or mild abrasive blasting. The cleaning shall extend beyond the damaged area to lap the undamaged galvanized coating at least 1/2 inch.

2) Weld flux residue, and weld splatter of a size or type that cannot be removed by blast cleaning shall be removed by chipping, scaling, or other mechanical means.

3) The cleaned area shall be preheated to at least 600°F but not more than 750°F. The surrounding galvanized area shall not be burned. The area to be repaired shall be wire brushed during this preheat.

4) The cleaned preheat area shall be rubbed with the repair alloy stick to deposit an evenly distributed layer of the zinc alloy.

5) The repair area shall be wiped with a damp cloth to remove flux residue.

6) Dry-film thickness shall be verified using a magnetic or electromagnetic-type gauge, in accordance with ASTM D 1186.

c. Shop or field-damaged areas shall be cleaned and recoated with a 4.0 mil minimum coating of zinc, using sprayed zinc (metalizing process).

1) Zinc wire used in repair shall contain not less than 99.98 percent zinc.

2) The surface to be repaired shall be blasted clean to white metal in accordance with SSPC-SP5. The area to be blasted clean shall extend at least 1/2 inch onto the surrounding coating areas.

3) Weld flux residue and weld splatter of a size or type that cannot be removed by blast cleaning shall be removed by chipping, scaling, or other mechanical means.

4) Sprayed coating shall be applied within 2 hours after surface preparation has been completed and before any visible deterioration (flash-rust) has occurred.

5) The coating shall be applied to the clean and dry surface by metal spraying pistols fed with zinc wire or zinc powder.

6) The surface of the sprayed zinc shall be of a uniform texture, free of lumps, coarse areas, and loosely adhered particles.

7) Dry film thickness shall be verified using a magnetic or electromagnetic-type gauge, in accordance with ASTM D 1186.

d. In the field, for areas where the hot bar or metalizing process methods cannot be used, and with the permission of the Engineer, the damaged areas shall be repaired with multiple coats of an approved coating such as Rustoleum Zinc Rich Cold Galvanizing Aerosol; CRC Zinc-It; Spray-on #740 Zinc-Rich; Sherwin Williams #140 Zinc-Rich; or approved equal.

1) The damaged area shall be cleaned and recoated with an organic zinc-rich pain to a minimum dry film thickness of 6.0 mils applied in two (2) coats.

2) The surface to be repaired shall be blast cleaned to white metal in accordance with SSPC-SP5. The area to be blasted clean shall extend at least 1/2 inch onto the surrounding sound coating area.

3) Weld flux residue and weld splatter or a size or type that cannot be removed by blast cleaning shall be removed by chipping, scaling, or other mechanical means.

4) In areas where abrasive blasting cannot be used or cannot effectively clean the required area, power disk sanding or other cleaning methods shall be sued, subject to approval of the Engineer.

5) Apply paint containing zinc dust to the prepared area as recommended by the paint manufacturer.

6) Dry film thickness shall be verified using a magnet or electromagnetic-type gauge, in accordance with ASTM D 1186.

3.04 COATINGS SCHEDULE

A. Standard Coating Schedule:

Surfaces	Surface Preparation	Coating	Color
Base Bid: Structural Columns, beams, and other framing members and fasteners	SP5	Galvanized	NA
Alternate Bid: Structural Steel Columns, beams, and framing members.	SP6	First Coat – Not less than 2 mils DFT Sherwin Williams Macropoxy 646. Top Coat – Not less than 4 mils DFT Sherwin Williams Macropoxy 646.	Color Selection by Owner

3.05 FINAL TOUCH-UP

A. Prior to Substantial Completion, examine coated surfaces and retouch or refinish to leave surfaces in condition acceptable to Engineer.

3.06 CLEANING

A. Prior to Substantial Completion, remove masking, coating, and other material from floors, glass, and other surfaces and remove rubbish and accumulated materials of whatever nature not caused by other trades from premises and leave in clean, orderly condition, with floors broom clean.

END OF SECTION

SECTION 09950

COATINGS FOR CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Exterior concrete paint and coating systems including surface preparation.

B. Supplier is responsible for surface preparation and coatings. Coating systems are identified in this Section.

1.02 RELATED SECTIONS

A. Section 03900 – Concrete Restoration and Cleaning

1.03 REFERENCES

A. Steel Structures Painting Council (SSPC):

1. SSPC-SP 13 / NACE No. 6 Surface Preparation for Concrete.

B. Material Safety Data Sheets / Environmental Data Sheets: Per manufacturer's MSDS/EDS for specific VOCs (calculated per 40 CFR 59.406). VOCs may vary by base and sheen.

1.04 SUBMITTALS

A. Product Data: For each paint system indicated, including.

1. Product characteristics.
2. Surface preparation instructions and recommendations.
3. Primer requirements and finish specification.
4. Storage and handling requirements and recommendations.
5. Application methods.
6. Cautions for storage, handling and installation.

B. Selection Samples: Submit a complete set of color chips that represent the full range of manufacturer's products, colors and sheens available.

C. Verification Samples: For each finish product specified, submit samples that represent actual product, color, and sheen.

D. Coating Maintenance Manual: Upon conclusion of project, the Contractor or paint manufacturer/supplier shall furnish a coating maintenance manual, such as Sherwin-Williams, "Custodian Project Color and Product Information" report or equal. Manual shall include an Area Summary with finish schedule, Area Detail designating where each product/color/finish was used, product data pages, Material Safety Data Sheets, care and cleaning instructions, touch-up procedures, and color samples of each color and finish used. "

E. Only submit complying products based on project requirements (i.e. LEED). One must also comply with the regulations regarding VOCs (CARB, OTC, SCAQMD, LADCO). To ensure compliance with district regulations and other rules, businesses that perform coating activities should contact the local district in each area where the coating will be used.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Paint exposed surfaces. If a color of finish, or a surface is not specifically mentioned, Architect will select from standard products, colors and sheens available.

C. Do not paint prefinished items, concealed surfaces, and labels unless indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver manufacturer's unopened containers to the work site. Packaging shall bear the manufacturer's name, label, and the following list of information.

1. Product name, and type (description).
2. Application and use instructions.
3. Surface preparation.
4. VOC content.
5. Environmental handling.
6. Batch date.
7. Color number.

B. Storage: Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

C. Store materials in an area that is within the acceptable temperature range, per manufacturer's instructions. Protect from freezing.

D. Handling: Maintain a clean, dry storage area, to prevent contamination or damage to the coatings.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.08 EXTRA MATERIALS

A. Furnish extra paint materials from the same production run as the materials applied and in the quantities described below. Package with protective covering for storage and identify with labels describing contents. Deliver extra materials to Owner.

B. Furnish Owner with an additional one percent of each material and color, but not less than 1 gal (3.8 l) or 1 case, as appropriate.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Paint:

1. Sherwin Williams – Basis of Design
2. Approved Other

2.02 APPLICATIONS/SCOPE

A. High Performance Exterior Paint and Coating Systems:

1. Concrete: existing and new

2.03 PAINT MATERIALS - GENERAL

A. Paints and Coatings:

1. Unless otherwise indicated, provide factory-mixed coatings. When required, mix coatings to correct consistency in accordance with manufacturer's instructions before application. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
2. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color. Or follow manufactures product instructions for optimal color conformance.

B. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.

C. Coating Application Accessories: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required, per manufacturer's specifications.

D. Color: As selected by owner

2.04 HIGH PERFORMANCE EXTERIOR PAINT AND COATING SYSTEMS

A. Concrete: Poured-in-place Concrete

1. Urethane System; Waterbased:

a. Gloss Finish:

1) 1st Coat: S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 (8 mils wet, 3.2 mils dry).

2) 2nd Coat: S-W Pro Industrial Waterbased Acrolon 100 Gloss, B65-720 Series.

3) 3rd Coat: S-W Pro Industrial Waterbased Acrolon 100 Gloss, B65-720 Series (4.0-8.0 mils wet, 1.8-3.6 mils dry per coat).

b. Gloss Finish Single Component:

1) 1st Coat: S-W Loxon Concrete and Masonry Primer Sealer, LX02W50 (8 mils wet, 3.2 mils dry).

2) 2nd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Urethane Gloss, B65-120 Series.

3) 3rd Coat: S-W Pro Industrial Pre-Catalyzed Waterbased Urethane Gloss, B65-120 Series (6.0-12.0 mils wet, 1.9-3.8 mils dry per coat).

2. Urethane System; Solvent Based:

a. Gloss Finish:

1) 1st Coat: S-W Loxon Concrete and Masonry Primer/Sealer, LX02W50 Series (5.3-8.0 mils wet. 2.1-3.2 mils dry.)

2) 2nd Coat: S-W Hi-Solids Polyurethane Gloss, B65/B60-30 Series.

3) 3rd Coat: S-W Hi-Solids Polyurethane Gloss, B65/B60-30 Series (4.5-8.0 mils wet, 3.0-5.0 mils dry per coat).

b. Semi-Gloss Finish:

1) 1st Coat: S-W Loxon Concrete & Masonry Primer/Sealer, LX02W50 Series (5.3-8.0 mils wet, 2.1-3.2 mils dry.

2) 2nd Coat: S-W Hi-Solids Polyurethane Semi-Gloss, B65-350/B60V30 Series.

3) 3rd Coat: S-W Hi-Solids Polyurethane Semi-Gloss, B65-350/B60V30 Series (4.5-8.0 mils wet, 3.0-5.0 mils dry per coat).

3. Polysiloxane System; Solvent Based:

a. Gloss Finish:

1) 1st Coat: S-W Loxon Concrete & Masonry Primer/Sealer, LX02W50 Series (5.3-8.0 mils wet. 2.1-3.2 mils dry).

2) 2nd Coat: S-W Sher-loxane 800, (5.0-7.0 mils wet, 4.0-6.0 mils dry per coat).

3) 2nd Coat: S-W Conflex 7 percent Siloxane Water Repellant, CF31T7 (50-200 sq ft/ gal).

PART 3 EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared; notify Architect of unsatisfactory conditions before proceeding. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

B. Proceed with work only after conditions have been corrected and approved by all parties, otherwise application of coatings will be considered as an acceptance of surface conditions.

C. Previously Painted Surfaces: Verify that existing painted surfaces do not contain lead based paints, notify Architect immediately if lead based paints are encountered.

3.02 SURFACE PREPARATION

A. General: Surfaces shall be dry and in sound condition. Remove oil, dust, dirt, loose rust, peeling paint or other contamination to ensure good adhesion.

1. Prior to attempting to remove mildew, it is recommended to test any cleaner on a small, inconspicuous area prior to use. Bleach and bleaching type cleaners may damage or discolor existing paint films. Bleach alternative cleaning solutions are advised.

2. Remove mildew before painting by washing with a solution of 1 part liquid household bleach and 3 parts of warm water. Apply solution and scrub the mildewed area. Allow solution to remain on the surface for 10 minutes. Rinse thoroughly with clean water and allow surface to dry before painting. Wear protective glasses or goggles, waterproof gloves, and protective clothing. Quickly wash off any of the mixture that comes in contact with your skin. Do not add detergents or ammonia to the bleach/water solution.

3. Remove items including but not limited to thermostats, electrical outlets, switch covers and similar items prior to painting. After completing painting operations in each space or area, reinstall items removed using workers skilled in the trades involved.

4. No exterior painting should be done immediately after a rain, during foggy weather, when rain is predicted, or when the temperature is below 50 degrees F (10 degrees C), unless products are designed specifically for these conditions. On large expanses of metal siding, the air, surface and material temperatures must be 50 degrees F (10 degrees F) or higher to use low temperature products.

B. Concrete, SSPC-SP13 or NACE 6: This standard gives requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems. The requirements of this standard are applicable to all types of cementitious surfaces including cast-in-place concrete floors and walls, precast slabs, masonry walls, and shotcrete surfaces. An acceptable prepared concrete surface should be free of contaminants, laitance, loosely adhering concrete, and dust, and should provide a sound, uniform substrate suitable for the application of protective coating or lining systems.

3.03 INSTALLATION

A. Apply all coatings and materials with the manufacturer's specifications in mind. Mix and thin coatings according to manufacturer's recommendations.

B. Do not apply to wet or damp surfaces. Wait at least 30 days before applying to new concrete or masonry. Or follow manufacturer's procedures to apply appropriate coatings prior to 30 days. Test new concrete for moisture content.

C. Apply coatings using methods recommended by manufacturer.

D. Uniformly apply coatings without runs, drips, or sags, without brush marks, and with consistent sheen.

E. Apply coatings at spreading rate required to achieve the manufacturers recommended dry film thickness.

F. Regardless of number of coats specified, apply as many coats as necessary for complete hide, and uniform appearance.

G. Inspection: The coated surface must be inspected and approved by the Architect just prior to the application of each coat.

3.04 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged coatings after substantial completion, following manufacturer's recommendation for touch up or repair of damaged coatings. Repair any defects that will hinder the performance of the coatings.

END OF SECTION

SECTION 09961

COATINGS FOR PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Coat surfaces to include:
    a. Interior and exterior piping, regardless of type of factory-applied finish, where color coding required.
    b. Color coded equipment and piping above suspended ceilings.
    c. Exterior and interior equipment, motors, and appurtenances.
2. Labeling and directional arrows on new and existing piping, equipment with valves or electrical connections, valves, and ducts whether coated or not.
3. Do not coat unless specifically noted otherwise:
    a. Factory-finished electrical motor control panels (MCC) and main instrument panels (MIP), flow Indicators, and related equipment.
    b. Underground equipment and piping.
    c. Surfaces above suspended ceiling systems (unless color coded).
    d. Plastic coated pipe insulation.
4. Do not coat over any code-required labels such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

B. Equipment manufacturer is responsible for surface preparation and coatings of equipment, motors, and appurtenances. Equipment to be coated and coating system are identified in equipment Specification section(s).

1.02 DEFINITIONS

A. Definitions as used in schedules.

1. Coatings: Heavy duty finishes for use on any surfaces, especially surfaces subject to submerged, high moisture, splash or chemical environment.
2. Ambient Conditions:
    a. Chemical: Surface subject to corrosive chemical splash or fumes.
    b. Moist: Surface subject to wet areas such as shower rooms and rooms with open tanks.
    c. Normal: Surface subject to normal temperatures and humidity such as found in offices and corridors.
3. Splash: Surface subject to frequent washing and chemical splash.
4. Submerged P: Surface submerged in potable water plus 1 ft 0 in. above high liquid level.

5. Submerged NP: Surface submerged in non-potable liquid such as sewage and sludge plus 1 ft 0 in. above high liquid level.

B. First Coat: Field prime, factory prime, or shop prime. When only one coat is required, first coat is finish coat.

C. Second or Third Coats: Successive finish coats applied over first coat.

1.03 SUBMITTALS

A. Product Data:

1. Submit manufacturer's literature stating application recommendations and generic makeup of each type of coating scheduled.

2. Substitutions: For coatings not specified, provide substitute manufacturer's literature with specified coating literature for ENGINEER to make proper evaluation.

B. Samples:

1. Actual color samples available for each type of coating scheduled.

2. Two 4 in. by 4 in. steel panels for each method of metal preparation specified. Panel shall be representative of steel used and prevented from deterioration of surface quality. Upon acceptance by ENGINEER, panel shall be preserved as reference source for inspection.

C. Miscellaneous:

1. Letter of Certification/Shop Painting:

a. Contractor has option of shop coating materials and equipment partially or totally.

b. If Contractor applies coatings in factory, submit following:

1) Coatings used.

2) Manufacturer's written certificate factory-applied coating system is identical to, or exceeds, specified requirements.

3) Requirements for touch-up or coating.

4) History of coating performance in same environment.

c. Submit following for factory-applied first coat.

1) First coat used.

2) Contractor's certification factory-applied first coat is compatible with field-applied finish coats.

2. Schedules:

a. Submit schedule of proposed coating systems within [30] [60] (90] calendar days of Award of Contract.

b. Schedule of proposed coating systems shall identify same information as shown in coating schedule.

D. Submit in accordance with Section 01330.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:

1. Engage an experienced applicator who has successfully completed coating system applications similar in material and extent to those indicated for Project.

B. Single-Source Responsibility:

1. Provide coating material produced by same manufacturer for each system. Use only thinners recommended by manufacturer and only within recommended limits.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver material in original, sealed, unopened packages and containers bearing manufacturer's name. Each container shall have manufacturer's printed label stating type of coating, color of coating, instructions for reducing, and spreading rate.

B. Protect and heat or cool material storage location to maintain temperature ranges recommended by coating manufacturer for most sensitive coating, but not less than 55°F.

C. Keep storage area neat and clean and replace or repair damage thereto or to its surroundings.

D. Avoid danger of fire. Deposit cleaning rags and waste materials in metal containers having tight covers or remove from building each night. Provide fire extinguishers of type recommended by coating manufacturer in areas of storage and where finishing is occurring. Allow no smoking or open containers of solvents. Store solvents in safety cans. [Give special attention to possible hazards in areas of existing buildings.]

E. Empty containers shall have labels canceled and be clearly marked as to use.

F. Upon Substantial Completion, remaining material will become property of Owner Seal material as required for storage, marked as to contents and shelf life, and store where required by Owner.

1.06 PROJECT/SITE CONDITIONS

A. Environmental Requirements:

1. Do not apply exterior coating in cold, foggy, damp or rainy weather.

2. Apply no finish in rooms where dust is being generated.

3. Do not apply exterior coating when temperature is lower than 50°F or as required by manufacturer.

4. Maintain interior temperature and relative humidity of space, as recommended by coating manufacturer, 24 hrs before applying and until coating is cured.

B. Protection:

1. Cover materials and surfaces, including floors, adjoining or below Work with clean drop cloths or canvas.

2. Remove hardware, accessories, plates, lighting fixtures, and similar items or provide protection by masking. Upon completion, replace above items or remove protection and clean.

3. Maintain manufacturer's environmental requirements while coating dries.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Coatings:

1. Tnemec.
2. Sherwin Williams.
3. Or Approved Equal.

2.02 MATERIALS

A. Coatings:

1. Color shall be formed of pigments free of lead, lead compounds or other materials which might be affected by presence of hydrogen sulfide or other gases likely to be present at Project.
2. Coatings shall meet surface burning characteristics as required by code and established by ASTM E84.

2.03 COLORS

A. Colors shall be selected and approved by ENGINEER.

B. Prior to beginning work, ENGINEER will provide color coordinating schedule. System color coding shall comply with Section 15075.

C. In areas scheduled for finishing, coat exposed piping, conduit, and ducts to match adjacent or near surfaces, except for color coding.

D. In areas where existing surfaces are coated, coat new exposed piping, conduit, and ducts to match adjacent or near surfaces, except for color coding.

E. Equipment Colors:

1. Coat equipment same color as piping equipment serves.
    a. Equipment includes pumps, tanks, frames and structural supports, fasteners, and attached portions of electrical conduit.

2.04 MIXING AND TINTING

A. Each coat shall be slightly darker than preceding coat, unless otherwise approved.

B. Tint undercoats similar to finish coats.

PART 3 EXECUTION

3.01 EXAMINATION

A. If surfaces to be finished cannot be put into proper condition for finishing by customary cleaning, sanding, and puttying operations or if surfaces were improperly primed by others, report defects to ENGINEER, in writing, or assume responsibility and correct unsatisfactory finish resulting from improper surfaces. Commencement of Work indicates acceptance of surfaces.

B. Materials removed and replaced to correct defects due to Work placed on unsuitable surfaces shall be at CONTRACTOR'S expense.

C. Where surface dryness is questioned, test with dampness indicating instrument. Do not apply coatings over surfaces where moisture content exceeds that permitted in manufacturer's printed instructions.

D. Provide coats compatible with the surface and prior coats.

3.02 SURFACE PREPARATION AND TOUCH-UP

A. General:

1. Surfaces, including floors shall be clean, dry, and free of loose dirt, dust, and foreign matter before applying coating.

2. Comply with coating manufacturer's recommendations for surface preparation.

B. Ungalvanized Ferrous Metal:

1. General:

a. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.

b. Prepare welds and adjacent areas to remove undercutting or reverse ridges on weld bead, weld spatter on or adjacent to weld or area to be coated, and sharp peaks or ridges along weld bead. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.

c. Coat surfaces same day prepared. Re-prepare surfaces starting to rust before coating.

2. Cleaning Methods:

a. Workmanship for metal surface preparation as specified shall conform with SSPC specifications as follows:

1) SP-1: Solvent Cleaning.

2) SP-2: Hand Tool Cleaning.

3) SP-3: Power Tool Cleaning.

4) SP-5: White Metal Blast Cleaning.

5) SP-6: Commercial Blast Cleaning.

6) SP-7: Brush-off Blast Cleaning.

7) SP-8: Pickling.

8) SP-10: Near-White Blast Cleaning.

b. Wherever "solvent cleaning," "hand tool cleaning," "wire brushing," or "blast cleaning," or similar words of equal Intent used in Specifications or coating manufacturer's specifications, they shall be understood to refer to applicable SSPC specifications listed above.

c. Use hand tools to clean areas that cannot be cleaned by power tools.

C. Galvanized Metal:

1. Touch-up damaged areas with zinc-rich primer.

2. Wash galvanized metal surfaces with mineral spirits or comparable manufactured products.

D. Plastic:

1. Solvent clean pipe in accordance with manufacturer's recommendations.

2. Hand sand with medium grit sandpaper to provide tooth for coating system.

3. Large areas may be power-sanded or brush-off blasted, provided sufficient controls employed so surface roughened without removing excessive material.

3.03 APPLICATION

A. General Requirements:

1. Spread evenly and flow on smoothly without runs, lumps or sags.

2. Make edges of coating adjoining other materials or colors sharp and clean without overlapping.

3. Number of coats and film thickness required is same regardless of application method. Do not apply succeeding coats until previous coat has cured as required by manufacturer. Where sanding is required, according to manufacturer's direction, sand between applications to produce smooth, even surface.

4. Finish edges of doors as specified for faces. Apply one coat finish on tops and bottoms of doors after fitting.

5. Term "exposed surfaces" includes areas visible when permanent or built-in fixtures, convector covers, covers for finned tube radiation, grilles, and similar components are in place. Extend coatings in these areas, as required, to maintain system's integrity and provide desired protection.

a. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces.

b. Coat back sides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.

c. Omit first coat on metal surfaces that have been shop-primed and touch-up painted.

6. Manufacturer-Applied Coating Systems:

a. Repair abraded areas on factory-finished items in accordance with manufacturer's directions.

b. Blend repaired areas into original finish.

7. Existing Surfaces:

a. If finish coat will not produce uniform coverage, provide first coat base over existing Work.

b. Where ceilings or walls scheduled for patching or remodeling, coat entire ceiling or wall in that area.

c. At altered rooms. Wherever new Work adjoins existing Work, finish new Work to match existing. Apply first coats as specified for new Work on new Work and wash adjacent existing coated surfaces and apply finish coat(s) over entire area.

8. Application Procedures:

a. Apply coatings by brush, roller, spray, or other applicators according to manufacturer's instructions.

B. Priming and Sealing:

1. Refer to Coating Schedule for specific coating material.

2. Shop:

a. Shop first coat for ferrous metal shall comply with SSPC guidelines, and as specified in Coating Schedules of this Specification.

b. Hand or power sand chipped, peeled or abraded first coat and feather edges. Spot coat areas with specified first coat.

c. Prior to application of finish coats, clean shop-first coat surfaces free of dirt, oil, and grease.

d. Prepare and prime holdback areas as required for specified coating system.

3.04 FIELD QUALITY CONTROL

A. Sampling of Materials:

1. ENGINEER reserves right to select unopened containers of materials furnished for project and have materials tested at an independent testing laboratory. OWNER will pay for first tests.

2. Retests of rejected materials and tests of replacement materials shall be paid for by CONTRACTOR

3. Remainder of contents of containers not required for testing will be returned to CONTRACTOR

B. Coverage:

1. Before beginning Work, finish one complete room, space surface, or item of each color scheme required, showing selected colors, finished texture, material, and workmanship. After approval, sample rooms or items shall serve as standard for similar Work throughout building.

2. If coverage is not acceptable to ENGINEER, ENGINEER reserves right to require extra application of paint at no extra cost to OWNER.

3. Work at site where coat of material is applied will be inspected by ENGINEER before application of succeeding specified coat, otherwise no credit for coat applied will be given and CONTRACTOR automatically assumes responsibility to recoat Work in question. Furnish ENGINEER report of particular coat applied and when completed for inspection to comply with above.

3.05 COATINGS SCHEDULE

A. General:

1. Unless otherwise noted, Tnemec and Ameron products are identified in this schedule to establish quality and type desired only.
2. Scheduled thickness or coverage rate is as recommended by Tnemec and Ameron. If other manufacturers are proposed and accepted, manufacturer's requirements shall be followed, but in no case may thickness or coverage rate be less.
3. OFT = dry film thickness {mils/coat). OFT shown is for spray application. Additional coats may be required if brushed and rolled.
4. sfpg = sq ft/gal (per coat).
5. Examples of surfaces to be coated are not all inclusive.

B. Standard Coating Schedule:

Example Surfaces	Surface Preparation	Tnemec Coating	Ameron Coating
COATING SYSTEM I (FERROUS METALS, INTERIOR MOIST/INTERIOR SPLASH, SEMI-GLOSS SHEEN, MAX TEMP 250F 3-COAT SYSTEM)			
Equipment, Pipes, Structural Members, Louvers, Pipe Hangers	SP6	First Coat – 3.0 to 5.0 DFT/"Series N69 Epoxoline or N140 Pota-Pox Plus" polyamidoamine epoxy. Second Coat – 4.0 to 6.0 DFT/"Series N69 Hi-Build Epoxoline" polyamidoamine epoxy. Third Coat – 4.0 to 6.0 DFT/"Series N69 Hi-Build Epoxoline" polyamidoamine epoxy.	First Coat – 3.0 to 5.0 mils DFT/"Amercoat 385" epoxy. Second Coat – 4.0 to 6.0 DFT/"Amerlock 400" epoxy. Third Coat – 4.0 to 6.0 DFT/Amerlock 400" epoxy.
COATING SYSTEM II (FERROUS METALS, DUCTILE IRON SUBMERGED NP "COLOR" GLOSS SHEEN, 3-COAT SYSTEM ON METAL, 2-COAT SYSTEM ON CONCRETE)			
Equipment, Pipes, Tanks, Structural Fabrications,	Ferrous Metal SP10 New Ductile Iron SP10	First Coat – 3.0 to 4.0 DFT/"Series N69 Epoxoline or N140 Pota-Pox Plus" polyamidoamine epoxy 1255 Beige. Second Coat – 6.0 to 8.0 DFT/"Series N69 Hi-Build Epoxoline" polyamidoamine epoxy. Third Coat – 6.0 to 8.0 DFT/"Series N69 Hi=Build Epoxoline" polyamidoamine epoxy. (Third coat not required on concrete).	First Coat – 3.0 to 4.0 DFT/"Amerlock 400" epoxy. Second Coat – 6.0 to 8.0 DFT/"Amerlock 400" epoxy. Third Coat – 6.0 to 8.0 DFT/"Amerlock 400" epoxy. (Third coat not required on concrete)
COATING SYSTEM III (PVC, INTERIOR ALL CONDITIONS, SEMI-GLOSS SHEEN, 1-COAT SYSTEM)			
Pipes, Equipment, Vinyl Coated Pipe Insulation	Lightly Sanded	First Coat – 5.0 DFT/"Series N69 Hi-Build Epoxoline" polyamidoamine epoxy.	First Coat – 5.0 DFT/Epoxy "Amerlock 400" epoxy.

3.06 SYSTEMS COLOR CODING AND LABELING SCHEDULE

A. Colors for piping and equipment in piping systems are specified in Section 15200.

B. Markings and labels are specified in Section 15075.

3.07 FINAL TOUCH-UP

A. Prior to Substantial Completion, examine coated surfaces and retouch or refinish to leave surfaces in condition acceptable to Engineer.

B. After doors have been fitted and hung, refinish edges, tops, and bottoms.

3.08 CLEANING

A. Prior to Substantial Completion, remove masking, coating, and other material from floors, glass, and other surfaces and remove rubbish and accumulated materials of whatever nature not caused by other trades from premises and leave in clean, orderly condition, with floors broom clean.

END OF SECTION

SECTION 13120

METAL BUILDING SYSTEMS

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. Structural-steel framing.
2. Metal Roof Deck
3. Accessories.

B. Related Sections:

1. Section 07410 – Insulated Metal Panels
2. Section 05310 – Metal Roof Deck

1.03 DEFINITIONS

A. Terminology Standard: See MBMA's "Metal Building Systems Manual" for definitions of terms for metal building system construction not otherwise defined in this Section or in referenced standards.

1.04 DESIGN REQUIREMENTS

A. Design Codes:

1. Michigan Building Code, 2015 Edition
2. ASCE 7-2010, Minimum Design Loads for Buildings and Other Structures
3. AISC 360-10, Manual of Steel Construction (14th Edition)

B. Occupancy Category: II

C. Roof Live Load: 20 pounds per square foot

D. Snow Load:

1. Ground Snow Load: 70 pounds per square foot
2. Importance Factor: 1.0
3. Exposure Category: C
4. Thermal Factor: 1.0 to 1.2

E. Wind Load:

1. Ultimate Wind Speed: 115 miles per hour
2. Exposure Category: C

3. Topographical Factor: 1.0

F. Seismic Load:

1. Importance Factor: 1.0
2. Site Class: D
3. Design Acceleration: SDS = 0.047g, SD1 = 0.032g
4. Seismic Design Category: A

1.05 ACTION SUBMITTALS

A. Product Data: For each type of metal building system component. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:

1. Structural-steel-framing system
2. Flashing and trim
3. Accessories

B. Metal Panel Layout Drawings: Refer to Specification Section 07410 Insulated Metal Panels. Show layouts of metal panels including methods of support. Include details of edge conditions, joints, panel profiles, corners, anchorages, trim, flashings, closures, and special details. Distinguish between factory- and field-assembled work; show locations of exposed fasteners.

1. Show roof-mounted items including roof hatches, equipment supports, pipe supports and penetrations, lighting fixtures, and items mounted on roof curbs.
2. Show wall-mounted items including doors, windows, louvers, and lighting fixtures.

C. Accessory Drawings: Include details of the following items, at a scale of not less than 1-1/2 inches per 12 inches:

1. Flashing and trim.

D. Samples for Initial Selection: For units with factory-applied color finish.

E. Samples for Verification: For each type of exposed finish required, prepared on Samples of sizes indicated below:

1. Metal Panels: Nominal 12 inches long by actual panel width. Include fasteners, closures, and other exposed panel accessories.
2. Flashing and Trim: Nominal 12 inches long. Include fasteners and other exposed accessories.
3. Accessories: Nominal 12-inch-long Samples for each type of accessory.

F. Delegated-Design Submittal: For metal building systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

B. Welding certificates.

C. Metal Building System Certificates: For each type of metal building system, from manufacturer.

1. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:

a. Name and location of Project

b. Order number

c. Name of manufacturer

d. Building dimensions including width, length, height, and roof slope.

e. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.

f. Governing building code and year of edition.

g. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).

h. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.

i. Building-Use Category: Indicate category of building use and its effect on load importance factors.

j. AISC Certification for Category MB: Include statement that metal building system and components were designed and produced in an AISC-Certified Facility by an AISC-Certified Manufacturer.

D. Manufacturer Certificates: For each product, from manufacturer.

E. Material Test Reports: For each of the following products:

1. Structural steel including chemical and physical properties.

2. Bolts, nuts, and washers including mechanical properties and chemical analysis.

3. Tension-control, high-strength, bolt-nut-washer assemblies.

4. Shop coatings.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for insulation and vapor-retarder facings. Include reports for thermal resistance, fire-test-response characteristics, water-vapor transmission, and water absorption.

G. Warranties: Sample of special warranties.

1.07 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panel finishes to include in maintenance manuals.

1.08 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer and member of MBMA.

1. AISC Certification for Category MB: An AISC-Certified Manufacturer that designs and produces metal building systems and components in an AISC-Certified Facility.

2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

C. Source Limitations: Obtain metal building system components, including primary and secondary framing and metal panel assemblies, from single source from single manufacturer.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3, "Structural Welding Code - Sheet Steel."

E. Structural Steel: Comply with AISC 360, "Specification for Structural Steel Buildings," for design requirements and allowable stresses.

F. Cold-Formed Steel: Comply with AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members" for design requirements and allowable stresses.

G. Fire-Resistance Ratings: Where indicated, provide metal panel assemblies identical to those of assemblies tested for fire resistance per ASTM E119 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2. Combustion Characteristics: ASTM E136.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, sheets, panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering.

C. Protect foam-plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic insulation materials to Project site before installation time.

1.10 COORDINATION

A. Coordinate sizes and locations of concrete foundations and casting of anchor-bolt inserts into foundation walls and footings. Concrete and anchor bolts by Others.

B. Coordinate wall framing with required rough openings for doors, windows, louvers and exhaust fans with sizes and locations as shown on the Drawings.

C. Coordinate wall framing with reinforced concrete knee wall, as shown on the Drawings.

D. Coordinate roof framing with required rough openings for hatches, as shown on the Drawings.

E. Coordinate metal panel assemblies with rain drainage work, flashing, trim, and construction of supports and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11 WARRANTY

A. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Nucor Building Systems

2. Star Building Systems; an NCI company

3. VP Buildings; a United Dominion company

2.02 METAL BUILDING SYSTEMS

A. Description: Provide a complete, integrated set of metal building system manufacturer's standard mutually dependent components and assemblies that form a metal building system capable of withstanding structural and other loads, thermally induced movement, and exposure to weather without failure or infiltration of water into building interior.

1. Provide metal building system of size and with bay spacings, roof slopes, and spans indicated.

B. Primary-Frame Type:

1. Rigid Clear Span: Solid-member, structural-framing system without interior columns.

OR

2. Truss-Frame Clear Span: Truss-member, structural-framing system without interior columns.

C. End-Wall Framing: Manufacturer's standard, for buildings not required to be expandable, consisting of primary frame, capable of supporting one-half of a bay design load, and end-wall columns.

D. Secondary-Frame Type: Manufacturer's standard purlins and joists and exterior-framed (bypass) girts.

E. Eave Height: As indicated on the drawings.

F. Bay Spacing: As indicated on the drawings.

G. Roof Slope: As indicated on the drawings.

H. Exterior Wall System: Refer to Specification Section 07410, Insulated Metal Panels.

I. Exterior Roof System: Refer to Specification Section 07410, Insulated Metal Panels.

2.03 METAL BUILDING SYSTEM PERFORMANCE

A. Delegated Design: Design metal building system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."

1. Design Loads: As indicated in Paragraph 1.04 but not less than that as required by MBMA's "Metal Building Systems Manual." and ASCE/SEI 7 and the International Building code with Michigan amendments.

a. Design steel structure to satisfactorily support the loads indicated in Paragraph 1.04 and in conformance with all applicable Building codes and local regulations.

2. Deflection Limits: Design metal building system assemblies to withstand design loads with deflections no greater than the following:

a. Purlins and Rafters: Vertical deflection of 1/240 of the span.

b. Girts: Horizontal deflection of 1/240 of the span.

c. Metal Roof Panels: Vertical deflection of 1/240 of the span.

d. Metal Wall Panels: Horizontal deflection of 1/240 of the span.

e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.

3. Drift Limits: Engineer building structure to withstand design loads with drift limits no greater than the following:

a. Lateral Drift: Maximum of 1/360 of the building height.

C. Seismic Performance: Metal building systems shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.

D. Thermal Movements: Allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Air Infiltration for Metal Wall Panels: Air leakage through assembly of not more than 0.06 cfm/sq. ft. of wall area when tested according to ASTM E283 at static-air-pressure difference of 6.24 lbf/sq. ft.

F. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at a wind-load design pressure of not less than 6.24 lbf/sq. ft.

G. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for Class 90.

H. Thermal Performance: Provide insulated metal panel assemblies with the following maximum U-factors and minimum R-values for opaque elements when tested according to ASTM C1363 or ASTM C518:

1. Refer to Specification Section 07410 – Insulated Metal Panels.

2.04 STRUCTURAL-STEEL FRAMING

A. Primary Framing: Manufacturer's standard primary-framing system, designed to withstand required loads and specified requirements. Primary framing includes transverse frames; rafter beams; sidewall, end-wall, and corner columns; and wind bracing.

1. General: Provide frames with attachment plates, bearing plates, and splice members. Factory drill for field-bolted assembly. Provide frame span and spacing indicated.

a. Slight variations in span and spacing may be acceptable if necessary to comply with manufacturer's standard, as approved by Engineer.

2. Rigid Clear-Span Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Interior columns are not permitted.

OR

3. Truss-Frame, Clear-Span Frames: Rafter frames fabricated from joist girders, and I-shaped column sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

4. Long-Bay Frames: I-shaped frame sections fabricated from shop-welded, built-up steel plates or structural-steel shapes. Provide interior columns fabricated from round steel pipes or tubes, or shop-welded, built-up steel plates.

5. Frame Configuration: One-directional sloped.

6. Exterior Column Type: Uniform depth or Tapered.

7. Rafter Type: Uniform depth or Tapered.

B. End-Wall Framing: Manufacturer's standard primary end-wall framing fabricated for field-bolted assembly to comply with the following:

1. End-Wall and Corner Columns: I-shaped sections fabricated from structural-steel shapes; shop-welded, built-up steel plates; or C-shaped, cold-formed, structural-steel sheet.
2. End-Wall Rafters: C-shaped, cold-formed, structural-steel sheet; or I-shaped sections fabricated from shop-welded, built-up steel plates or structural-steel shapes.

C. Secondary Framing: Manufacturer's standard secondary framing, including purlins, girts, eave struts, flange bracing, base members, gable angles, clips, headers, jambs, and other miscellaneous structural members. Unless otherwise indicated, fabricate framing from either cold-formed, structural-steel sheet or roll-formed, metallic-coated steel sheet, prepainted with coil coating, to comply with the following:

1. Purlins: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; minimum 2-1/2-inch wide flanges.
   a. Depth: As needed to comply with system performance requirements.
2. Purlins: Steel joists of depths indicated.
3. Girts: C- or Z-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes. Form ends of Z-sections with stiffening lips angled 40 to 50 degrees from flange, with minimum 2-1/2-inch wide flanges.
   a. Depth: As required to comply with system performance requirements.
4. Eave Struts: Unequal-flange, C-shaped sections; fabricated from built-up steel plates, steel sheet, or structural-steel shapes; to provide adequate backup for metal panels.
5. Flange Bracing: Minimum 2-by-2-by-1/8-inch structural-steel angles or 1-inch diameter, cold-formed structural tubing to stiffen primary-frame flanges.
6. Sag Bracing: Minimum 1-by-1-by-1/8-inch structural-steel angles.
7. Base or Sill Angles: Minimum 3-by-2-inch zinc-coated (galvanized) steel sheet.
8. Purlin and Girt Clips: Manufacturer's standard clips fabricated from steel sheet. Provide galvanized clips where clips are connected to galvanized framing members.
9. Secondary End-Wall Framing: Manufacturer's standard sections fabricated from zinc-coated (galvanized) steel sheet.
10. Framing for Openings: Channel shapes; fabricated from cold-formed, structural-steel sheet or structural-steel shapes. Frame head and jamb of door openings and head, jamb, and sill of other openings.
11. Miscellaneous Structural Members: Manufacturer's standard sections fabricated from cold-formed, structural-steel sheet; built-up steel plates; or zinc-coated (galvanized) steel sheet; designed to withstand required loads.

D. Bracing: Provide adjustable wind bracing as follows:

1. Rods: ASTM A36/A 36M; ASTM A572/A572M, Grade 50 (345); or ASTM A529/A529M, Grade 50 (345); minimum 1/2-inch diameter steel; threaded full length or threaded a minimum of 6 inches at each end.

2. Angles: Fabricated from structural-steel shapes to match primary framing, of size required to withstand design loads.

3. Rigid Portal Frames: Fabricated from shop-welded, built-up steel plates or structural-steel shapes to match primary framing; of size required to withstand design loads.

E. Bolts: Provide plain-finish bolts for structural-framing components that are primed or finish painted. Provide hot-dip galvanized bolts for structural-framing components that are galvanized.

F. Materials:

1. W-Shapes: ASTM A992/A992M; ASTM A572/A572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55 (345 or 380).

2. Channels, Angles, M-Shapes, and S-Shapes: ASTM A36/A36M; ASTM A572/A 572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55 (345 or 380).

3. Plate and Bar: ASTM A36/A36M; ASTM A572/A572M, Grade 50 or 55 (345 or 380); or ASTM A529/A529M, Grade 50 or 55 (345 or 380).

4. Steel Pipe: ASTM A53/A53M, Type E or S, Grade B.

5. Cold-Formed Hollow Structural Sections: ASTM A500, Grade B or C, structural tubing.

6. Structural-Steel Sheet: Hot-rolled, ASTM A1011/A1011M, Structural Steel (SS), Grades 30 through 55 (205 through 380), or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480); or cold-rolled, ASTM A1008/A1008M, Structural Steel (SS), Grades 25 through 80 (170 through 550), or High-Strength Low-Alloy Steel (HSLAS), Grades 45 through 70 (310 through 480).

7. Metallic-Coated Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grades 33 through 80 (230 through 550) ,or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G60 (Z180) coating designation; mill phosphatized.

8. Metallic-Coated Steel Sheet Prepainted with Coil Coating: Steel sheet, metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A755/A755M.

   a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grades 33 through 80 (230 through 550) , or High-Strength Low-Alloy Steel (HSLAS), Grades 50 through 80 (340 through 550); with G90 (Z275) coating designation.

   b. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, Structural Steel (SS), Grade 50 or 80 (340 or 550); with Class AZ50 (AZM150) coating.

9. Joist Girders: Manufactured according to "Standard Specifications for Joist Girders," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as required for primary framing. Joist Girders may be employed as components of moment resisting building frames.

10. Steel Joists: Manufactured according to "Standard Specifications for Open Web Steel Joists, K-Series," in SJI's "Standard Specifications and Load Tables for Steel Joists and Joist Girders"; with steel-angle, top- and bottom-chord members, and end- and top-chord arrangements as indicated and required for secondary framing.

11. Non-High-Strength Bolts, Nuts, and Washers shall not be used in this work.

    a. Finish: Hot-dip zinc coating, ASTM A153/A 153M, Class C.

12. High-Strength Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, heavy-hex steel structural bolts; ASTM A563 (ASTM A563M) heavy-hex carbon-steel nuts; and ASTM F436 (ASTM F436M) hardened carbon-steel washers.

    a. Finish: Hot-dip zinc coating, ASTM A153/A153M, Class C. Hot dipped zinc coated bolts, nuts and washers shall be provided as assemblies.

13. High-Strength Bolts, Nuts, and Washers: ASTM A490 (ASTM A490M), Type 1, heavy-hex steel structural bolts or tension-control, bolt-nut-washer assemblies with spline ends; ASTM A563 (ASTM A563M) heavy-hex carbon-steel nuts; and ASTM F 436 (ASTM F436M) hardened carbon-steel washers, plain.

14. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F1852, Type 1, heavy-hex-head steel structural bolts with spline ends.

    a. Finish: Mechanically deposited zinc coating, ASTM B695, Class 50

G. Finish: Factory coated. Apply specified coating immediately after cleaning and pretreating.

1. Structural Steel used for primary and secondary framing and bracing shall be galvanized unless otherwise agreed.

2. Surfaces to receive painting shall be cleaned and prepared in accordance with SSPC SP6.

3. After surface preparation, surfaces to receive painting shall be coated with one (1) base coat of not less than 2 mils dry film thickness of Sherwin Williams Macropoxy 646, Fast Cure Epoxy or approved equal and one top coat of not less than 4 mils dry film thickness of Sherwin Williams Macropoxy 646, Fast Cure Epoxy, Light Gray Color or approved equal. Paint shall be well worked into all areas to receive touch-up painting.

4. Paint shall be applied in accordance with the manufacturer’s printed instructions.

5. Paint shall only be applied when surfaces are dry and the temperature of the surface metal exceeds 45°F.

6. Dry film thickness shall be measured using Mikrotest 102 gage, with a range between 0 and 40 mils, or an approved equal. One reading shall be taken each 20 square feet. At least two (2) readings shall be taken for each rolled or built-up member. Readings shall not exceed the specified thickness by more than 50 percent.

7. All coatings shall be applied without skipped areas, runs, sags, overspray, mud cracking, peel, blisters, delamination, or other deleterious effects. Areas with such defects shall be re-cleaned and coating reapplied.

8. Painted surfaces shall be protected and at no time placed in contact with other steel or on the ground. Damage to coatings shall be repaired according to the manufacturer's latest recommendations and as approved by the Buyer.

9. Paint shall be delivered for application in the original, undamaged and sealed containers, each bearing the manufacturer's name, batch number, date of manufacture, and shelf life. Rejected paint shall be removed.

2.05 FOAM-INSULATION-CORE METAL PANELS

A. Refer to Specification Section 07410 – Insulated Metal Panels.

2.06 ACCESSORIES

A. General: Provide accessories as standard with metal building system manufacturer and as specified. Fabricate and finish accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes. Comply with indicated profiles and with dimensional and structural requirements.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.

B. Metal Panel Accessories: Provide components required for a complete insulated metal panel assembly including copings, fasciae, mullions, sills, corner units, clips, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal wall panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same material as metal panels.

2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.

3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch thick, flexible closure strips; cut or premolded to match metal wall panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Formed from 0.022-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating; finished to match adjacent metal panels.

1. Provide flashing and trim as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers.

2. Opening Trim: Formed from 0.034-inch nominal-thickness, metallic-coated steel sheet or aluminum-zinc alloy-coated steel sheet prepainted with coil coating. Trim head and jamb of door openings, and head, jamb, and sill of other openings.

D. Materials:

1. Fasteners: Self-tapping screws, bolts, nuts, self-locking rivets and bolts, end-welded studs, and other suitable fasteners designed to withstand design loads. Provide fasteners with heads matching color of materials being fastened by means of plastic caps or factory-applied coating.

a. Coordinate fasteners with Specification 07410 – Insulated Metal Panels.

b. Blind Fasteners: High-strength aluminum or stainless-steel rivets.

2. Metal Panel Sealants: Coordinate with Specification 07410 – Insulated Metal Panels.

2.07 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate product.

B. Testing: Test and inspect shop connections for metal buildings according to the following:

1. Bolted Connections: Shop-bolted connections shall be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A 490 Bolts."

2. Welded Connections: In addition to visual inspection, shop-welded connections shall be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at inspector's option:

a. Liquid Penetrant Inspection: ASTM E165.

b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.

c. Ultrasonic Inspection: ASTM E164.

d. Radiographic Inspection: ASTM E94.

C. Product will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

2.08 FABRICATION

A. General: Design components and field connections required for erection to permit easy assembly.

1. Mark each piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and instruction manuals.

2. Fabricate structural framing to produce clean, smooth cuts and bends. Punch holes of proper size, shape, and location. Members shall be free of cracks, tears, and ruptures.

B. Tolerances: Comply with MBMA's "Metal Building Systems Manual" for fabrication and erection tolerances.

C. Primary Framing: Shop fabricate framing components to indicated size and section, with baseplates, bearing plates, stiffeners, and other items required for erection welded into place. Cut, form, punch, drill, and weld framing for bolted field assembly.

1. Make shop connections by welding or by using high-strength bolts.

2. Join flanges to webs of built-up members by a continuous, submerged arc-welding process.

3. Brace compression flange of primary framing with steel angles or cold-formed structural tubing between frame web and purlin web or girt web, so flange compressive strength is within allowable limits for any combination of loadings.

4. Weld clips to frames for attaching secondary framing.

5. Shop Priming: Prepare surfaces for shop priming according to SSPC-SP 2. Shop prime primary framing with specified primer after fabrication.

D. Secondary Framing: Shop fabricate framing components to indicated size and section by roll-forming or break-forming, with baseplates, bearing plates, stiffeners, and other plates required for erection welded into place. Cut, form, punch, drill, and weld secondary framing for bolted field connections to primary framing.

1. Make shop connections by welding or by using non-high-strength bolts.

2. Shop Priming: Prepare uncoated surfaces for shop priming according to SSPC-SP 2. Shop prime uncoated secondary framing with specified primer after fabrication.

PART 3 EXECUTION

3.01 DELIVERY TO SITE

A. Contractor shall be responsible for scheduling of delivery and delivery to the site in accordance with the Schedule and Milestone dates specified in Section 01010 Project Summary and Work Sequence.

B. The protection of the shipped items shall be the responsibility of the Building Procurement Contractor. Any damaged items will not be accepted and shall be replaced by the Building Procurement Contractor at no additional expense to the Owner.

END OF SECTION

SECTION 15012

DUCTILE IRON PIPING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Detailed requirements for various ductile iron piping products. Some products specified in this Section may not be required for this Contract. Refer to piping system specification section(s) and Drawings to determine particular ductile iron piping products to be provided under this Contract.

1.02 SUBMITTALS

A. Product Data:

1. Manufacturer's specifications, catalog cuts, and literature:

a. Pipe.

b. Inside linings.

c. Mechanical and push-on joints.

d. Flanged joints.

e. Grooved joints.

f. Standard fittings.

g. Special fittings.

h. Wall pipe and floor pipe.

i. Polyethylene encasement.

B. Submit outside coating system for buried, interior, exterior, and submerged piping locations.

C. Submit product data and coatings system information specified above in 1 complete submittal.

D. Submit in accordance with Section 01330.

E. Shop drawings showing layout for ductile iron piping systems shall be submitted in accordance with and transmitted under appropriate piping system specification section.

PART 2 PRODUCTS

2.01 PIPE

A. Liquid and air service pipe: AWWA C151, ductile iron.

B. Gas service pipe: ANSI A21.52, ductile iron. In addition to pipe marking required by ANSI A21.52, conspicuously stamp each pipe with words "AIR TESTED".

C. Minimum Thickness Class:

1. Mechanical and push-on joint pipe: Thickness Class 52, unless specified otherwise in piping system specification section.
2. Flanged joint pipe: Thickness Class 53.
3. Grooved joint pipe:

Pipe Size (in.)	Thickness Class
4 to 16	53
18	54
20	55
24	56

2.02 INSIDE LINING

A. Pipe and fittings shall be provided unlined or with inside lining as specified in piping system specification section.

B. Cement lining shall be in accordance with AWWA C104.

C. Glass lining:

1. Glass-lined products shall be furnished to CONTRACTOR by glass lining manufacturer. Glass lining manufacture shall supply pipe, fittings, fabrication, glass lining and outside coating.
2. Manufacturers:
   a. VITCO Corporation, Waterford, PA.
3. Special glasses and inorganic materials applied in minimum of two coats. Apply base coat and fire to temperature above 1,400º F to fuse glass to metal. Process subsequent coats in similar manner to form integral molecular bond with base coat. Finished lining shall be as follows:
   a. Thickness: 0.008 to 0.012 in.
   b. Hardness: 5 to 6 on Mohs Scale.
   c. Density: 2.5 to 3.0 grams per cu cm.
   d. Sufficiently bonded to metal surface to withstand strain of 0.001 in./in. without damage to glass lining.
   e. Resistant to corrosion by solutions of between ph-3 and ph-10 at 125ºF.
   f. Withstand thermal shock of 350ºF without crazing, blistering, or spalling.
   g. No visible loss of surface glass after immersion in 8% sulphuric acid solution at 148º for 10 min.
   h. Weight loss not more than 3 mg per sq in. when tested according to ASTM C283.
   i. Visually free of pinholes, crazing or fish scales which expose metal.

4. Fabrication of glass lined pipe shall be performed by glass lining manufacturer. Fabrication or cutting of pipe outside of glass lining manufacturer's shop is unacceptable.

D. Ceramic Epoxy Lining:

1. Manufacturers:

a. Protecto 401.

b. Amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment.

c. Thickness: 40 mils nominal.

d. Surface preparation and application in accordance with coating manufacturer's recommendations.

E. Pipe and fittings for air and gas service shall be unlined.

2.03 JOINTS

A. Joint Type:

1. Liquid and air services in buried locations shall be mechanical or push-on joint.

2. Gas service in buried locations shall be mechanical joint.

3. Gas service in locations other than buried shall be flanged joint.

4. Liquid and air service in locations other than buried shall be flanged or grooved end joint.

5. As shown on Drawings or as specified in system Specification if different than specified above for services and locations.

B. Mechanical and Push-on Joints:

1. AWWA C111.

2. Gasket material:

a. Suitable for service and maximum operating temperature of piping system as specified in piping system specification section.

b. Selected by pipe manufacturer.

3. Restrained Joints:

a. Manufacturers:

1) American Cast Iron Pipe Company, Flex-Ring, and Lok-Ring.

2) U.S. Pipe and Foundry Company, TR-Flex.

b. Provide restrained joints for buried piping systems specifically identified to have restrained joints and for buried piping systems where use of concrete thrust blocks is not practical.

c. Mechanical locking type to provide restraint from joint separation without use of restraining rods, straps, clamps, or set screw retainer glands.

d. Minimum pressure rating: 250 psi.

C. Flanged Joints:

1. Flanged pipe for liquid and air service shall be in accordance with AWWA C115.
2. Flanged pipe for gas service shall be in accordance with AWWA C115 and ANSI A21.52. In addition to pipe marking specified in AWWA C115 and ANSI A21.52, conspicuously stamp each flanged pipe with words “AIR TESTED”.
3. Fabrication of flanged pipe, including assembly of flange on pipe shall be performed by pipe manufacturer in accordance with AWWA C115. Assembly of flange on pipe outside of manufacturer’s shop is unacceptable.
4. Flange material for flanged pipe shall be ductile iron. Flanged pipe with gray iron flanges is not acceptable.
5. Gasket material shall be suitable for service and maximum operating temperature for piping system as specified in piping system specification section. Torque requirement of gaskets shall be less than torque rating of flange, bolt, and nuts.
6. Gaskets shall be ring or full face, 1/8in. thick, and conform to dimensions shown in Appendices to AWWA C110 and AWWA C115.
7. Bolts:
    a. Size, length, and number as shown in AWWA C110 and AWWA C115.
    b. Material: Carbon steel, ASTM A307, Grade B.
    c. Dimensions: ANSI B18.2.1, heavy hex.
8. Nuts:
    a. Size, length, and number as shown in AWWA C110 and AWWA C115.
    b. Material: Carbon steel, ASTM A307, Grade B.
    c. Dimensions: ANSI B18.2.2, heavy hex.

D. Grooved Joints:

1. AWWA C606.
2. Rigid joint. Pipe ends radius cut grooved to rigid groove specifications.
3. Grooved couplings shall be Victaulic Style 31, or equal.
4. Grooved joint adapter flanges shall be Victaulic Styles 341 or 342, or equal.
5. Gasket material:
    a. Suitable for service and maximum operating temperature of piping system as specified in piping system specifications section.
    b. Selected by grooved coupling manufacturer.
6. Coatings for grooved couplings and adapter flanges shall be same product as coatings for pipe.

2.04 FITTINGS

A. Pressure rating shall be 250 psi, minimum.

B. Standard fittings for liquid and air service:

1. Mechanical and push-on joint fittings:
    a. Ductile iron.
    b. AWWA C110 or AWWA C153.
2. Flanged joint fittings:
    a. Ductile iron.
    b. AWWA C110.
    c. Flange dimensions in accordance with AWWA C115.
3. Grooved joint fittings:
    a. Ductile iron.
    b. AWWA C110 except end preparation and wall thickness.
    c. End preparation in accordance with AWWA C606, rigid radius groove.
    d. Minimum wall thickness in accordance with AWWA C153.

C. Special fittings for liquid and air service, not included in AWWA standards, shall be manufacturer's standard, based on AWWA design principles, and in compliance with applicable requirements of AWWA standards.

D. Standard fittings for gas service:
1. Mechanical joint fittings: ANSI A21.14, ductile iron.
2. Flanged joint:
    a. ANSI A21.14, ductile iron.
    b. Flange dimensions in accordance with AWWA C115.

E. Special fittings for gas service, not included in ANSI standard, shall be manufacturer's standard, based on ANSI design principles, and in accordance with applicable requirements of ANSI standard.

F. Wall Pipe and Floor Pipe:
1. Ductile iron.
2. Wall thickness of body equal to or greater than wall thickness of connecting pipe.
3. Flanges set flush with face of concrete shall be tapped for stud bolts.
4. Collar dimensions as shown on Drawings.
5. Collar cast integral with pipe or fabricated by welded attachment of collar to pipe.
6. Fabricated wall pipe and floor pipe shall be as follows:
    a. Rated for dead end thrust due to 250 psi internal pressure.
    b. Ductile iron collar welded continuously around pipe on both sides of collar.
    c. Weld in pipe manufacturer's shop by qualified welder.
    d. Electrodes: AWA A5.15, Class ENiFE-Cl or QWS 5.6, Class ECuAl-2.

e. Manufacturer: American Cast Iron Pipe Company, or equal.

G. Miscellaneous Fittings:

1. Provide miscellaneous fittings, such as cutting in sleeves, tapping sleeves, caps, plugs, and other fittings, as required for complete system.

2. Manufacturer of miscellaneous fittings shall be same manufacturer as pipe.

3. Miscellaneous fittings shall be suitable for service.

2.05 OUTSIDE COATING

A. Provide buried piping with asphaltic coating in accordance with applicable AWWA and ANSI standards.

B. Surface preparation, priming, and finish coating of non-buried piping shall be compatible as follows:

1. Interior piping: System 42-C except use System 3-C if maximum operating temperature of piping system exceeds temperature rating of System 42-C.

2. Exterior piping: System 46-C except use System 4-C if maximum operating temperature of piping system exceeds temperature rating of System 46-C.

3. Submerged piping in non-potable liquid: System 6-C.

4. Submerged piping in potable water: System 21-C.

C. Finish color for interior and exterior piping shall be as specified in piping system Specification section.

D. Coating for piping embedded in concrete is not required.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with piping system Specification section and Drawing details.

3.02 JOINT ASSEMBLY

A. Push-on, mechanical, and grooved joint in accordance with manufacturer's written instructions.

B. Flanged joint in accordance with piping system specification section, flanged pipe manufacturer's written instructions, and gasket manufacturer's written instructions.

3.03 WALL PIPE

A. Support by formwork to prevent contact with reinforcing steel.

B. Install in accordance with Section 03300.

3.04 TAPPING

A. Do not tap polyethylene-lined and glass-lined pipe.

B. Taps for cement-lined and unlined pipe shall be in accordance with pipe manufacturer's instructions.

C. Provide service saddles for tap sizes greater than 1 in. Service saddles are not required for tap sizes 1 in. and smaller.

END OF SECTION

SECTION 15030

MANUALLY-ACTUATED VALVES AND CHECK VALVES

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:

1. Process mechanical manually actuated valves and check valves. Process mechanical valves and check valves are shown or noted on Process-Mechanical Drawings and on Civil Cite Piping Drawings. Civil Site Piping Drawings may also show site utility plumbing, fire protection and HVAC valves which are specified in other sections.

2. Valve accessories.

B. Some products specified in this section may not be required in this contract. Refer to other specifications and drawings to determine particular products to be provided under this contract.

1.02 SUBMITTALS

A. Product data:

1. Manufacturer's standard product data and catalog information for valves and accessories.

2. Provide for each different type number and size of valve:

a. Dimensioned drawing of valve and valve accessories showing valve, actuator mounted on valve, valve mounted accessories, and required clearances.

b. Indicate pressure rating (list unseating rating separately if different than seating), materials of construction, end connection type, size, actuator type, and manufacturer's product number.

3. Indicate valve type number from this specification on product data and catalog information.

4. For valves used in chemical services, submit valve manufacturer's chemical resistance guide showing suitability of valve materials for service conditions.

B. Submit in accordance with Section 01330.

C. Operation and Maintenance (O&M) data:

1. Submit in accordance with Section 01330.

1.03 QUALITY ASSURANCE

A. Provide valves and accessories with same type number from one manufacturer to achieve standardization for operation, maintenance, spare parts, and manufacturer's services.

PART 2 PRODUCTS

2.01 GENERAL

A. Services for valve types specified are shown on drawings.

B. Cast name of valve manufacturer and size of valve on body or bonnet or show on permanently attached stainless steel plate in raised letters.

C. Cast on valve body or indicate on operator word “open” and arrow indicating direction to open.

2.02 BALL VALVES

A. Type BV-1: Use for general air and water services.

1. Manufacturers:

a. Conbraco, Apollo 77-100 Series.

b. Engineer approved equal.

2. 2 ½ in. and smaller.

3. Full bore ports.

4. Bronze, with teflon seats.

5. Screwed ends.

6. Hand lever actuator.

7. Rated 600 psig WOG, 150 psi SWP.

8. Blow-out-proof stem design.

B. Type BV-2: Use where ball valves shown on PVC piping systems.

1. Manufacturers:

a. Spears 2000 Industrial.

b. Asahi Duo Bloc True Union.

c. Nibco True Bloc True Union.

d. Engineer approved equal.

2. ½ in. through 3 in.

3. Double union design, with two-way blocking capability.

4. ASTM D1784, Type 1, Grade 1 PVC body, ball, stem, union nuts, and end connectors.

5. Teflon seats.

6. Viton or teflon O-ring seals as recommended by valve manufacturer for service conditions.

7. Solvent weld socket ends.

8. Hand lever actuator.

9. Rated 150 psi at 120°F. Suitable for vacuum service.

C. Type BV-3: Use where ball valves shown on CPVC piping systems.

1. Manufacturers:
    a. Spears 2000 Industrial.
    b. Asahi Duo Bloc True Union.
    c. Nibco True Bloc Tru Union.
    d. Engineer approved equal.
2. ½ in. through 3 in.
3. Double union design, with two-way blocking capability.
4. Class 23477-B, ASTM D1784, CPVC body, ball, stem, union nuts, and end connectors.
5. Teflon seats.
6. Viton or Teflon O-ring seals, as recommended by valve manufacturer for service condition.
7. Solvent weld socket ends.
8. Hand lever actuator.
9. Rated 150 psi at 120°F. Suitable for vacuum service.
10. For valves in sodium hypochlorite service, valve shall be manufacturer's vented ball design.

D. Type BV-4: Use where ball valves shown on PVDF piping systems.

1. Manufacturers:
    a. Asahi Duo Bloc True Union.
    b. Nibco True Bloc Tru Union.
    c. Engineer approved equal.
2. ½ in. through 2 in.
3. Double union design, with two-way blocking capability.
4. ASTM D3222, Type 1 PVDF body, ball, stem, union nuts, and end connectors.
5. Teflon seats.
6. Viton or Teflon O-ring seals, as recommended by valve manufacturer for service conditions.
7. Thermal fusion ends.
8. Hand lever actuator.
9. Rated 150 psi at 73°F.
10. For valves in sodium hypochlorite service, valve shall be manufacturer's vented ball design.

E. Type BV-5: Ball valves for caustic piping system:

1. Forged or cast bodies.

2. ASME Class 150.
3. Fluroelastomer resins shall be used for seating materials.
4. Full bore design.
5. Suitable for 50% sodium hydroxide.

2.03 BUTTERFLY VALVES

A. Type BF-1: Use for ALP services in piping systems with maximum service temperatures of 250°F or less.

1. Manufacturers:
   a. DeZurik Model BRS.
   b. Keystone AR2.
   c. Engineer approved equal.
2. 2 in. through 36 in.
3. Lug type body.
4. Cast iron body, bronze disc, Type 316 or 416 stainless steel stem.
5. Reinforced TFE, TFE-coated stainless steel, stainless steel or sintered steel bearings at both ends.
6. EPDM replaceable resilient seat.
7. Suitable for installation between ANSI 125 and 150 lb. flanges.
8. Valve actuator:
   a. Valves 6 in. and smaller: Locking lever.
   b. Valves 8 in. and larger: Totally enclosed, worm and gear, handwheel actuator.
9. Bubbletight at 150 psi differential pressure when higher pressure on flat side of disc, 100 psi differential pressure when higher pressure on curved side of disc.
10. EPDM, PTFE or NBR shaft seals.
11. Rated for service temperatures up to 250°F.

B. Type BF-2: Use for ALP service in piping systems with maximum service temperatures greater than 250°F but equal to or less than 400°F.

1. Manufacturers:
   a. DeZurik Model BHP.
   b. Keystone K-Lok.
   c. Engineer approved equal.
2. 2 in. through 60 in.
3. Lug type body.
4. Carbon steel body, nickel coated carbon steel disc or 316 stainless steel disc, Type 316 or 416 stainless steel stem.

5. Teflon coated stainless steel bearings or 316 stainless steel bearings.
6. Reinforced teflon replaceable resilient seat.
7. Suitable for installation between ANSI 125 and 150 lb. flanges.
8. Valve actuator.
    a. Valves 6 in. and smaller: Locking lever.
    b. Valves 8 in. and larger: Totally enclosed, worm and gear, handwheel actuator.
9. Rated 200 psi minimum bubbletight shutoff at 400°F with pressure in either direction.
10. Rated for service temperatures up to 400°F.

C. Type BF-3: Use for all services except those listed under other butterfly valve types.
1. Manufacturers:
    a. Bray Series 35.
    b. Henry Pratt.
    c. Engineer approved equal.
2. For sizes 22” and larger.
3. Full flanged, rated for 75 psi differential pressure.
4. Body: ASTM A125/150 ductile iron.
5. Disc: Nylon coated ductile iron.
6. Shaft: Type 304 stainless steel with self-lubricating, PTFE or nylon composite bearings.
7. Seat: Buna N.
8. 125 lb. flanged ends faced and drilled in accordance with ASTM 125/150.
9. Totally enclosed, geared, handwheel actuator, unless shown otherwise.

2.04 GATE VALVES

A. Type GV-1: Use for water services.
1. Manufacturers:
    a. Stockham Valves and Fittings.
    b. Milwaukee Valve Company, Inc.
    c. Nibco F-617-0.
    d. Engineer approved equal.
2. 2 ½ in. and larger.
3. Flanged ends, Class 125.
4. ASTM A126, Class B iron body.
5. Bolted bonnet.

6. ASTM A62 bronze-solid wedge for 3 in. and smaller, cast iron wedge for 4 in. and larger.
7. Outside screw and yoke.
8. Handwheel actuator unless noted otherwise.

B. Type GV-2: Large diameter process water

1. DeZurik, KGC-ES, or approved equal.
2. Provide with untapped lugs for installing between existing flanges.
3. Provide with operator as specified on drawings.
4. Cast stainless steel gate.
5. 100% full port design.

2.05 PINCH VALVES

A. Type PV-1:

1. Manufacturers:
   a. Red Vale, Model Series 75.
   b. Engineer approved equal.
2. ½ in. through 24 in.
3. Unobstructed flow through valve in open position.
4. In closed position, upper and lower bars to compress sleeve to form leakproof seal. Design closing mechanism so upper and lower pinch bars move at same time as handwheel is turned.
5. Use high strength nylon fabric for reinforcement.
6. Cast iron body.
7. Molded Buna N sleeve.
8. Valve operating parts isolated from process flow.
9. Handwheel actuator.
10. Flange size, facing and drilling: Conform to ANSI B16.1, Class 125 lb. cast iron fittings.
11. Pressure ratings:
    a. $\leq$ 6 in.: 150 psi.
    b. 8 in. through 12in.: 100 psi.
    c. 14 in.: 75 psi.
    d. 16 in. through 24 in.: 50 psi.

2.06 GLOBE VALVES

A. Type GL-1:

1. Manufacturers:

a. Crane Company Figure 14-1/2 P.

b. Milwaukee Valve 591A.

c. Engineer approved equal.

2. 1/8 in. through 2 in.

3. Union bonnet, inside screw, rising stem, plug type disc.

4. Bronze body, bonnet, and stem.

5. Replaceable stainless plug and seat.

6. Screwed ends.

7. Handwheel actuator.

8. Rated 300 psi WOG.

B. Type GL-2: Use where globe valves shown on PVC and CPVC piping system.

1. Manufacturers:

a. Asahi.

b. Engineer approved equal.

2. ½ in. through 2 in.

3. PVC body, bonnet, stem and gland.

4. Polypropylene disc and handwheel.

5. EPDM body to bonnet gaskets and stem packing.

6. Solvent weld socket ends.

7. Handwheel activator.

8. Rated 150 psi at 105°F.

2.07 PLUG VALVES

A. Type PV-1: Use for all services where eccentric plug valve is shown on drawings except as listed under other plug valve types.

1. Manufacturers:

a. DeZurik PEC.

b. Val-Matic.

c. Pratt Ballcentric.

d. Engineer approved equal.

2. ½ in. through 3 in.

3. Eccentric, nonlubricated, with O-ring seals.

4. Cast iron body, stainless steel bearings.

5. Balanced plug coated with Hycar.

6. Screwed ends, except provide flanged ends for flanged piping systems.

7. Rated 175 psi pressure differential drip type shutoff with pressure in either direction.

8. Attached lever actuator except valves installed on piping having test pressures greater than 25 psig shall have handwheel actuator.

9. Handwheel actuators sized for 175 psi WOG, bubbletight shutoff at rated pressure in seating and unseating pressure conditions.

B. Type PV-2: Use for all services where eccentric plug valve is shown on drawings except as listed under other plug valve types.

1. Manufacturers:

a. DeZurik PEC.

b. Val-Matic.

c. Pratt Ballcentric.

d. Engineer approved equal.

2. 4 in. and greater.

3. Eccentric, non-lubricated.

4. Buna-V packing or O-ring seals.

5. Cast iron body (ASTM A126 Grade B), stainless steel bearings through 20 in. valves, bronze bearings for valves greater than 20 in. Nickel seats.

6. Balanced plug coated with Hycar.

7. Flanged ends meeting 125 lb. ANSI standards except mechanical joint ends for buried valves.

8. Rated 150 psi pressure differential drip type shutoff with pressure in either direction.

9. Provide valve actuator as follows.

a. Valves 4 in. and smaller: Wrench lever, unless noted otherwise. Valves installed on piping having test pressures greater than 25 psig shall have handwheel actuator.

b. Valves 6 in. and larger: Totally enclosed, worm and gear, handwheel actuator; unless noted otherwise.

10. Size handwheel actuators for 150 psi WOG, bubbletight shutoff in seating and unseating pressure conditions. Handwheels and chainwheels shall not be more than 2 times gear size diameter.

2.08 CHECK VALVES

A. Type CV-1:

1. Manufacturers:

a. Milwaukee Valve Company, Figure 509.

b. Nibco T-413.

c. Engineer approved equal.

2. 2 in. and smaller.
3. Swing type disc, Y-pattern, or conventional body.
4. Bronze.
5. Regrinding seat.
6. Screwed ends and cap.
7. Rated 200 lb. WOG.

B. Type CV-2

1. Manufacturers:
   a. GA Industries, Inc., Figure 220.
   b. Engineer approved equal.
2. 2 ½ in. through 12 in.
3. Swing check with outside lever and weight.
4. Cast iron body and trim with stainless steel hinge shafts, cast iron disc.
5. Flanged ends meeting 125 lb. ANSI standards.
6. Rated 200 lb. WOG.
7. Stainless steel body seat, resilient field replaceable seat ring on disc.

C. Type CV-3:

1. Manufacturers:
   a. GA Industries, Inc., Figure 250-D.
   b. Engineer approved equal.
2. 14 in. and larger.
3. Swing check with outside lever, weight and air cushion chamber.
4. Cast iron body, bronze or stainless steel seat ring, non-corrosive weight shaft and cushion chamber, stainless steel hinge shaft.
5. Flanged ends meeting 125 lb. ANSI standards.
6. 200 lb. WOG.

D. Type CV-4:

1. Manufacturers:
   a. Flygt HDL.
   b. GA Industries, Inc., Figure 240.
   c. Engineer approved equal.
2. 3 in. and larger.
3. Ball check suitable for vertical up or horizontal flow.
4. Sinking type hollow steel ball with vulcanized nitrile rubber exterior.
5. Iron body.

6. Flanged ends meeting ANSI B16.1, Class 125 standards.
7. Rated 150 lb. WOG.

E. Type CV-5: Use where ball check valves are shown on PVC piping systems.

1. Manufacturers:
   a. Spears.
   b. Asahi.
   c. Nibco.
   d. Engineer approved equal.
2. ½ in. to 4 in.
3. Ball check suitable for vertical or horizontal flow.
4. True Union connectors, solvent weld socket ends.
5. PVC body.
6. EPDM or Viton carrier O-rings, seat O-rings and end connector O-rings. Material as recommended by valve manufacturer for service conditions.
7. Rated 110 psi minimum at 120°F.

F. Type CV-6: Use where ball check valves are shown on CPVC piping systems.

1. Manufacturers:
   a. Spears.
   b. Asahi.
   c. Nibco.
   d. Engineer approved equal.
2. ½ in. to 4 in.
3. Ball check suitable for vertical or horizontal flow.
4. True union connectors, solvent weld socket ends.
5. CPVC body.
6. EPDM or Viton carrier O-rings, seat O-rings and end connector O-rings. Material as recommended by valve manufacturer for service conditions.
7. Rated 130 psi minimum at 120°F.

2.09 SPECIALTY VALVES

A. Type TV-1:

1. Manufacturers:
   a. Latanick Equipment, Inc.
   b. Engineer approved equal.
2. Telescopic valve, rising stem.
3. Designed for vertical travel shown on drawings.

4. Self-braking and self-locking.
5. Rack and pinion worm gear actuator.
6. Stainless steel floor stand.
7. Stainless steel bail, slip tube, gasket retainer, lift rod and jam nut.
8. Cast iron companion flange with adjustable and replaceable slip tube gasket.
9. Slip tube suitable and sized for sliding in pipe shown on drawings and specified.
10. Non-V-notch slip tube.

B. Type MV-1:

1. Manufacturers:
   a. Troy Valve.
   b. Engineer approved equal.
2. Mud valves, 3 in. through 24 in.
3. Flanged frame, non-rising stem.
4. Cast iron body, bronze disc ring and seat ring.
5. Provide with stainless steel extension stem having 2in. sq operating nut. Provide stem supports.
6. Extension stem length as required to place operating nut at elevation shown on drawings. If no elevations are shown, stem length as required to place operating nut 3 in. below bottom of grating. Cut hole in grating for operation of operating nut. Provide removable stainless steel plate for hole in grating.

2.10 ACCESSORIES

A. Valve Actuators:

1. Open valve by turning counterclockwise.
2. Provide actuator type as specified under each valve specification above, unless otherwise shown or specified.
3. For valves, 3 in. and larger, provide chain wheel actuator if centerline of valve handwheel or lever operator is 5 ft. 6 in. or greater above operating floor. Provide chain wheel actuator for other sizes of valves if noted on drawings or specified.
   a. Provide chain wheel actuated valves with enclosed worm and gear operators.
4. Provide valves with chain lever actuator if shown on drawings.

B. Chain wheels and chain levers:

1. Provide chain wheels with guides and chain having proof coil design.
2. Provide chain levers with chain having proof coil design.
3. Galvanize or cadmium plate chain wheels, chain levers, guides, and chain.
4. Chain size as recommended by valve manufacturer.
5. Extend chains to within 4 ft. of operating floor.

6. Provide chain hooks and tieback anchors for chains. Install so chain does not interfere with personnel traffic.

C. Worm and gear actuators:

1. Totally enclosed design.
2. Sized for valve operation under valve rated pressure with pull of 40 lbs. on handwheel or chain wheel.
3. Self-locking to prevent valve position creep.
4. Hardened alloy steel worm.
5. Reduction gearing runs in lubricant.
6. Orientate operators to avoid interference with adjacent piping, equipment, and structures.
7. Valve position indication.

D. Valve boxes:

1. Provide for buried valves.
2. Three-piece screw type, cast iron box and cover.
3. Valve box dia. of 5 ¼ in. with length as required for installation.
4. Provide valve with extension stem, complete with operating nut, to bring operating nut to point 6 in. below box cover.

E. Floor boxes:

1. Provide for valves as shown on drawings.
2. Cast iron box and cover.
3. Provide valve with extension stem, complete with operating nut, to bring nut to point 6 in. or less below box cover.

F. Buried and submerged valve actuators:

1. Provide seals on shafts and gaskets on valve and actuator covers to prevent water entry.
2. Provide totally enclosed actuator mounting brackets with gasket seals.

G. Extension stems for submerged valves:

1. Provide for valves as shown on drawings.
2. Provide with intermediate stem guides with maximum spacing not exceeding 10 ft. or L/R not exceeding 200.
3. Type 304 stainless steel.

H. Floorstands:

1. Provide for valves if shown on drawings.
2. Provide with worm and gear actuator.

PART 3 EXECUTION

3.01 COATING

A. Shop surface preparation, shop priming, and field coating shall be as per manufacturer's recommendations per the application.

1. Coat valves same color as pipe in which they are installed.

3.02 INSTALLATION

A. Install according to manufacturer's instructions and approved submittals.

B. Bolt holes of flanged valves shall straddle vertical centerline of pipe run. Before installing flanged valves, clean flanged faces. After cleaning, insert gasket and bolts, and tighten nuts progressively and uniformly.

3.03 FIELD QUALITY CONTROL

A. Tests:

1. Pressure test valves at same time adjacent piping is tested.

2. If valve leaks under pressure, loosen valve threads or joint, loosen or remove nuts and bolts, reseat or replace gasket, retighten or reinstall nuts and bolts, and retest joints.

3. Protect part of valves or operators that could be damaged by test.

END OF SECTION

SECTION 15060

PIPE HANGERS, SUPPORTS, AND ANCHORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. System of pipe supports and anchors with necessary inserts, bolts, nuts, restraining and hanger rods, washers, miscellaneous steel, and other accessories.

1.02 DEFINITIONS

A. Submerged: At or below point 1 ft. 6 in. above peak (maximum) water surface elevations in water holding structure.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:

1. Design, detail and installation of pipe support system shall be responsibility of CONTRACTOR.
2. Pipe support system components shall withstand dead loads imposed by weight of pipes filled with water plus insulation, plus live loads due to thermal expansion, vibration, internal test pressures, and have minimum safety factor of 5.
3. Absence of pipe supports and details on Drawings shall not relieve CONTRACTOR of responsibility for providing them throughout plant.

1.04 SUBMITTALS

A. Shop Drawings:

1. Pipe supporting system, including manufacturer's product data, dimensions, sizes, types, location, maximum loadings, thrust anchorage, and installation instructions.
2. Provide pdf.
3. Stamped by Professional Engineer registered in the State of Michigan.

B. Submit in accordance with Section 01330.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fee and Mason.

B. Grinnell.

C. Carpenter-Patterson.

D. Unistrut.

E. Superstrut.

F. Engineer approved equal.

2.02 GENERAL

A. MSS types indicated are typical of types and quality of standard pipe supports and hangers to be employed.

B. Provide factory fabricated piping hangers and supports, clamps, hanger rod attachments, building attachments, saddles, shields, thrust anchorage, and other miscellaneous products of MSS SP-69 type indicated or shop fabricated supports; comply with MSS SP-58 and manufacturer's published product information. Where MSS type not indicated, provide proper selection for installation requirements and comply with MSS SP-69, MSS SP-89 and manufacturer's published product information.

2.03 MATERIALS

A. Hangers, rods, clamps, protective shields, metal framing, support components, and hanger accessories shall be galvanized unless otherwise noted.

B. Hangers, rods, clamps, protective shields, metal framing, support components, and hanger accessories in submerged locations in wet wells, tanks, channels or tank covers shall be Type 316 stainless steel.

2.04 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General:

1. Unless otherwise shown or specified, hangers for 2-1/2 in. and smaller pipe shall be spring, adjustable swivel, clevis or roller type, hangers for 3 in. pipe or greater shall be clevis or roller type.

2. Hangers for use with spring supports shall be split-ring or clamp type.

3. Hangers for fiberglass reinforced pipe shall be saddle type.

4. Each hanger shall be designed to permit at least 1-1/2 in. vertical adjustment after installation.

B. Adjustable Swivel Split-Ring Hanger: MSS Type 6.

C. Adjustable Clevis Hanger: MSS Type 1, fabricated from steel.

D. Adjustable Band Hanger: MSS Type 7, fabricated from steel.

E. Adjustable Swivel-Band Hanger: MSS Type 10.

F. Clamp: MSS Type 4.

G. Single Roll Support MSS Type 41, including axle roller and threaded sockets.

H. Adjustable Roller Hanger: MSS Type 43, including axle roller and clevis.

I. Roll/Stand: MSS Type 44, including roller, stand, and axle.

J. Adjustable Roll/Base: MSS Type 46, including roller, adjustable base, and stand.

K. Steel Brackets. Welded structural steel shapes complying with following:

1. Light Duty: MSS Type 31.

2. Medium Duty: MSS Type 32.

3. Heavy Duty: MSS Type 33.

L. Adjustable Saddle Support:

1. MSS Type 38, including saddle, pipe, and reducer.

2. Fabricate base support from steel pipe and include cast iron flange or welded steel plate.

M. Stanchion Saddle Support:

1. MSS Type 37, including saddle and U-bolt.

2. Fabricate base support from steel pipe and Include cast iron flange or welded steel plate.

N. Strap or wire hangers not acceptable.

2.05 VERTICAL PIPING CLAMPS

A. 2-Bolt Riser Clamp: MSS Type 8, galvanized or plastic coated.

B. 4-Bolt Riser Clamp: MSS Type 42, include pipe spacers at inner bolt holes, galvanized or plastic coated.

2.06 HANGER RODS AND ATTACHMENTS

A. Hanger Rods:

1. ASTM A36, threaded both ends or continuous threaded.

2. Rods shall conform to following sizes:

Pipe	Minimum Rod Dia (in.)
Up to 2 in.	3/8
2-1/2 in and 3 in.	1/2
4 in.	5/8
6 in.	3/4
8 in.to 12 in.	7/8
14 in. and Up	1
Trapeze Hangers	As Required

B. Turnbuckles: MSS Type 13.

C. Weldless Eye Nut: MSS Type 17.

D. Eye Socket: MSS Type 16.

E. Clevis: MSS Type 14.

2.07 BUILDING ATTACHMENTS

A. Individual Concrete Inserts:

1. MSS Type 18, malleable iron.

2. MSS Type 19, steel.
3. Minimum Safe Load: 1,100 lbs.

B. Continuous Concrete Inserts:
1. Unistrut, P-3200 Series.
2. Fee and Mason, Figure 9000.
3. Superstrut.
4. Engineer approved equal.

C. Top Beam C-Clamp: MSS Type 19.

D. C-Clamps: MSS Type 23, steel.

E. Single-Side Clamp: MSS Type 25.

F. Top I-Beam Clamp: MSS Type 25.

G. Side Beam Clamp: MSS Type 20.

H. Concrete Anchors:
1. Comply with Section 05500.
2. Minimum Safety Factor: 5.

2.08 SADDLES AND SHIELDS

A. Protection Saddles: MSS Type 39.

B. Protection Shields: MSS Type 40.

C. Wood Insulation Saddle:
1. Eleen Metal Products Company.
2. Engineer approved equal.

2.09 MISCELLANEOUS MATERIALS

A. Metal Framing Systems:
1. Unistrut, galvanized.
2. Fee and Mason, galvanized.
3. Engineer approved equal.

B. Shop-Fabricated Anchors and Supports:
1. Steel Plates, Shapes, and Bars: ASTM A36.
2. Restraining Rods: ASTM A307.

PART 3 EXECUTION

3.01 GENERAL

A. Proceed with installation of hangers, supports, and anchors after required building structural work is complete and concrete support structure has reached 28-day compressive strength.

B. Install hangers, supports, clamps, and attachments from building structure. Comply with MSS SP-69. Group parallel runs of horizontal piping to be supported together on trapeze type hangers where possible.

C. Install supports to provide indicated pipe slopes and maximum pipe deflections allowed by ANSI B31.1 are not exceeded.

D. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and style as installed for adjacent similar piping.

E. Do not support piping from other piping.

F. Prevent contact between dissimilar metals. Where concrete or metal pipe support is used, place 1/8 in. thick teflon, neoprene rubber or plastic strip under piping at point of bearing. Cut to fit entire area of contact between pipe and support.

G. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, plastic coated or by other recognized industry methods. Electrician's tape not acceptable isolation method.

H. Apply anti-seize compound to nuts and bolts.

3.02 INSTALLATION OF BUILDING ATTACHMENTS

A. Support piping from structural framing, unless otherwise noted.

B. Concrete Inserts:

1. Locate inserts so total load on insert does not exceed manufacturer's recommended maximum load. Location of inserts shall be approved by ENGINEER.

2. Where necessary to anchor supports to hardened concrete or completed masonry, use concrete anchors.

C. Attach to structural steel with beam clamps.

3.03 THRUST ANCHORS AND GUIDES

A. Thrust Anchors:

1. For suspended piping, center thrust anchors as closely as possible between expansion joints and between elbows and expansion joints. Anchors shall hold pipe securely and be sufficiently rigid to force expansion and contraction movement to take place at expansion joints or elbows and preclude separation of joints.

2. Provide thrust anchors as required to resist thrust due to changes in diameter or direction or dead ending of pipe lines. Anchorage shall be required wherever bending stresses exceed allowable for pipe. Wall pipes may be used as thrust anchors.

3. Restraining rod size and number shall be as shown on Drawings.

B. Pipe guides shall be provided adjacent to sliding expansion joints in accordance with recommendations of National Association of Expansion Joint Manufacturers.

3.04 PIPE SUPPORT

A. Spacing:

Steel Pipe	Maximum Pipe Support Spacing (ft.)
10 in. and over	22
8 in.	19
6 in.	17
5 in.	16
4 in.	14
3-1/2 in.	13
3 in.	12
2-1/2 in.	11
2 in.	10
1-1/2 in.	9
1 in.	7
¾ in.	6
½ in.	5

Copper Pipe	Maximum Pipe Support Spacing (ft.)
4 in.	12
3-1/2 in.	11
3 in.	10
2-1/2 in.	9
2 in.	8
1-1/2 in.	8
1-1/4 in.	7
1 in.	5
¾ in.	5
½ in.	5

Plastic Pipe (Schedule 80 at 100°F)	**Maximum Pipe Support Spacing (ft.)**
8 in.	
6 in.	
4 in.	
3 in.	
2 in.	
1-1/2 in.	
1 in.	
¾ in.	
½ in.	
(For plumbing application plastic piping shall be supported at maximum of 4 ft-0 in. spacing.)	

Stainless Steel Pipe	**Maximum Pipe Support Spacing (ft.)**
1 in. and smaller	6
1-1/2 in. through 4 in.	8
6 in.	8
8 in. and 10 in.	10
12 in.	10
14 in.	12
16 in.	12
18 in. and larger	14

Cast Iron and Ductile Iron Pipe	Maximum Pipe Support Spacing (ft.)
1 in. and smaller	6
1-1/4 in. through 2-1/2	8
3 in. and 4 in.	10
6 in.	12
8 in.	12
10 in. and 12 in.	14
14 in.	16
16 in. and 18 in.	16
20 in.	18
24 in. and larger	18
(For cast iron soil pipe plumbing applications, support at 5 ft-0 in. spacing)	

B. Where piping of various sizes is to be supported together, space supports for smallest pipe size or install intermediate supports for smaller diameter pipe.

C. Provide minimum of 2 pipe supports for each pipe run.

D. Where piping connects to equipment, support by pipe support and not by equipment unless approved by equipment manufacturer.

E. Unless otherwise shown or authorized by ENGINEER, place piping running parallel to walls approximately 1-1/2 in. out from face of wall and at least 3 in. below ceiling.

F. Pedestal pipe supports shall be adjustable with stanchion, saddle, and anchoring flange.

G. Piping supports for vertical piping passing through floor sleeves shall be galvanized steel riser clamps.

H. Piping passing through sleeves or openings in interior wall sleeves shall be carried by supports or hangers. Do not rest on wall.

I. Support piping in manner preventing undue strain on valve, fitting or equipment. Provide pipe supports at changes in direction or elevation, adjacent to flexible couplings, adjacent to non-rigid joints, and where otherwise shown. Do not install pipe supports and hangers in equipment access areas [or bridge crane runs].

J. Install supports to allow controlled movement of piping systems, permit freedom of movement between pipe anchors, and facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

K. Piping shall be free to move when expands or contracts, except where fixed anchors are indicated. Where adequate hanger rod swing length cannot be provided or where pipe movement based on expansion of 1 in./100 ft. for each 100°F change in temperature exceed 1/2 in., provide approved roller supports.

L. Support piping 6 in. and larger on trapeze hangers with rollers.

M. Stacked horizontal runs of piping along walls may be supported by metal framing system attached to concrete insert channels.

N. Coat hangers, clamps, protective shields, metal framing support components, and hanger accessories in accordance with Division 9.

3.05 GALLERY AND TUNNEL PIPING

A. Support piping by metal framing system. Where possible, extend each insert channel continuously over gallery or tunnel ceiling and down both walls to floor.

3.06 INSULATED PIPING

A. Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed allowable pipe stresses.

B. Where low compressive strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. For pipe 8 in. and over, install wood insulation saddles.

C. Where insulation without vapor barrier is indicated, install protection saddles on piping 2 in. and larger.

END OF SECTION

SECTION 15075

PIPING AND EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Plastic pipe markers.
2. Valve tags.
3. Engraved plastic laminate signs.
4. Plastic equipment markers.

B. Identification furnished as part of equipment is specified as part of equipment assembly in other sections and shall comply with requirements of this section.

C. Refer to Division 16 sections for identification requirements of electrical and instrumentation work, not work of this section.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required. Submit listing of each flow stream identifier with associated color coding.

B. Samples: Submit samples of each color, lettering style, and other graphic representation required for each identification material or system.

C. Submit in accordance with Section 01330.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of identification devices of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 yrs.

B. Regulatory Requirements:

1. ANSI Standards: Comply with ANSI A 13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Marking Services, Inc.

B. Brady (W.H.) Company, Signmark Division.

C. Industrial Safety Supply Company, Inc.

D. Seton Name Plate Corporation.

E. Engineer approved equal.

2.02 MECHANICAL IDENTIFICATION MATERIALS

A. Provide manufacturer's recommended products as specified for each application.

B. Where more than single type is specified for application, selection is installer's option, but provides single selection for each product category.

C. Bands, markers, and identification materials used in mechanical rooms and process locations shall be rated for exterior application and suitable for withstanding occasional wash down.

2.03 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations, and other designations used in mechanical identification work with corresponding designations shown, specified or scheduled. Provide numbers, lettering, and wording as indicated or if not indicated, as recommended by manufacturers or required for proper identification and operation and maintenance of mechanical systems and equipment.

B. Multiple Systems: Where multiple systems of same generic name are shown or specified, provide identification indicating individual system number as well as service (i.e., Boiler No. 3, Air Supply Unit No. 10-ASU-2, etc.).

2.04 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide preprinted, semi-rigid snap-on, color coded pipe markers complying with ANSI A13. 1.

B. Pressure Sensitive Type: Provide preprinted, permanent adhesive, color coded, pressure sensitive vinyl pipe markers complying with ANSI A13.1. Dot matrix printing is not acceptable.

C. Small Pipes: For external diameters less than 6 in. (including insulation, if any), provide full band pipe markers, extending 360 deg. around pipe at each location, fastened by 1 of following methods:

1. Snap-on application of pretensioned, semi-rigid plastic pipe marker.
2. Adhesive lap joint in pipe marker overlap.
3. Taped to pipe (or insulation) with color coded plastic adhesive tape not less than 4 in. wide, full circle at both ends of pipe marker, tape lapped 1-1/2 in.

D. Large Pipes: For external diameter 6 in. and larger (including insulation, if any), provide either full band or strip type pipe markers not narrower than 3 times letter height (and of required length), fastened by one of following methods:

1. Taped to pipe (or insulation) with color coded plastic adhesive tape, not less than 4 in. wide, full circle at both ends of pipe marker, tape lapped 3 in.
2. Strapped to pipe (or insulation) application of semi-rigid type with manufacturer's standard stainless steel bands.

E. Lettering: Comply with piping system nomenclature as specified, scheduled or shown and abbreviate only as necessary for each application length, and only with approval of ARCHITECT/ENGINEER. Lettering height shall be as follows:

Outside Pipe Dia. (in.)	Minimum Letter Height (in.)	Minimum Length of Marker (in.)
3/4 to 1-1/4	1/2	8
1-1/2 to 2	3/4	8
2-1/2 to 6	1-1/4	12
8 to 10	2-1/2	24
over 10	3-1/2	32

F. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as separate unit of plastic.

G. Label and band colors in accordance with ANSI A 13.1, Pipe Identification Schedule (Section 15200) and following:

1. Lettering and arrows:

a. Black on yellow background for inherently hazardous materials.

b. White on blue (gaseous) or green (liquid) for low hazard materials.

c. White on red background for fire quenching materials.

2. Banding: Colors and band spacing as scheduled or as shown on Drawings.

2.05 VALVE TAGS

A. Process Valve Tags: Fiberglass valve tags with printed embedded lettering; piping system abbreviation in approximately 3/16 in. high letters, valve numbers approximately 3/8 in. high, and 5/32 in. hole for fastener.

1. Provide 2-1/2 in. by 4 in. sq white tags with black lettering with identification system in accordance with P&ID drawings.

B. Valve Tag Fasteners: Solid brass chain (wire link or beaded type) or solid brass S-hooks of sizes required for proper attachment of tags to valves, manufactured specifically for purpose.

2.06 ENGRAVED PLASTIC LAMINATE SIGNS

A. Engraving stock melamine plastic laminate complying with FS L-P-387A (1) in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting necessary because of substrate.

B. Thickness: 1/16 in. for units up to 20 sq in. or 8 in. length, 1/8 in. for larger units.

C. Fasteners: Self-tapping stainless steel screws except contact type permanent adhesive where screws cannot or should not penetrate substrate.

2.07 PLASTIC EQUIPMENT MARKERS

A. 2-ply, 1/8 in. thick laminated engraved plastic, engraved.

1. Color: Black letters on white background.

B. Nomenclature: Include following, matching terminology on schedules as closely as possible:

1. Equipment name (i.e. chilled water pump No. 1).

2. Equipment Tag No. (i.e. 30-P-1).

C. Size: Provide approximate 3 in. by 6 in. (minimum) for equipment.

1. 1 in. high letters for equipment tag number.

2. 1/2 in. high letters for descriptive equipment name.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces requiring insulation, painting or other covering or finish including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. Provide pipe markers on all piping and equipment in accordance with information presented on P&ID drawings and this specification section and Section 15200.

B. Locate pipe markers with arrows and color bands as follows wherever piping exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums), and exterior non-concealed locations.

1. Near each valve and control device.

2. Near locations where pipes pass through walls or floors, ceilings, or enter non-accessible enclosures.

3. At access doors, manholes, and similar access points permitting view of concealed piping.

4. Near major equipment items and other points of origination and termination.

5. Spaced intermediately at maximum spacing of 30 feet along each piping run, except reduce spacing to 20 feet in congested areas of piping and equipment.

6. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

C. Locate color bands at each marker and at intermediate spacing not to exceed 10 feet between bands, and at lesser spacing as indicated or as required by local codes.

D. Locate directional arrows at each marker. Provide 2 arrows at each tee or branch fitting.

E. Where piping is normally visible from more than 1 side, provide 2 or 3 labels and arrows spaced at 120 degree intervals around pipe in accordance with ANSI A13.1.

F. Painting or Coating:

1. Painting of piping, ductwork, and equipment is work of Division 9.

2. Colors listed are general.

3. For piping scheduled to be color-coded, but not scheduled for complete painting (such as some plastic piping or aluminum jacked insulation) provide additional banding to represent background color. At each banding location provide following sequence:

   a. 8 in. wide tape of scheduled pipe color.

   b. 4 in. wide tape of scheduled band color.

   c. 8 in. wide tape of scheduled pipe color.

3.03 PROCESS VALVE IDENTIFICATION

A. Install engraved plastic marker or fiberglass tag at each process valve, gate, or flow control device as identified by P&ID tag numbers on Drawings.

3.04 MECHANICAL EQUIPMENT IDENTIFICATION

A. Install engraved plastic laminate sign or plastic equipment marker on or near each major item of mechanical equipment and each operational device, if not otherwise specified for each item or device. Provide signs for each unit having equipment tag number on Drawings or in Specifications.

3.05 ADJUSTING AND CLEANING

A. Adjusting: Relocate any mechanical identification device visually blocked.

B. Cleaning: Clean face of identification devices and glass frames of valve schedules.

3.06 FIELD QUALITY ASSURANCE

A. Final Survey and Repairs:

1. Prior to final completion but 1 year after date of substantial completion, CONTRACTOR shall perform walk-through survey of mechanical identification systems and shall remove and replace any bands, labels, tags or markers that are loose, discolored, or defective.

2. Replacement materials shall be provided by CONTRACTOR, not drawn from OWNER'S extra material.

END OF SECTION

SECTION 15122

METERS AND GAUGES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Pressure Gauges and Fittings:

a. Pressure gauges.

b. Pressure gauge isolation diaphragms.

c. Pressure gauge isolation valve.

B. Meters and gauges furnished as part of factory-fabricated equipment may be specified as part of equipment assembly in other Division 15 sections.

1.02 SUBMITTALS

A. Product Data:

1. Manufacturer's technical product data, including installation instructions, for each type meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated.

2. Meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

3. Indicate Tag Number for each gage proposed.

B. Submit in accordance with Section 01330.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of meters and gauges, of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 yrs.

B. Regulatory Requirements:

1. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

2. ANSI and ISA Compliance: Comply with applicable portions of ANSI and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Manufacturers:

1. Ametek/U.S. Gauges.

2. Ashcroft

3. Marsh Instrument Company, Unit of General Signal.
4. Marshalltown Instruments, Inc.
5. Trerice (H.O.) Company.
6. Weiss Instruments, Inc.
7. Engineer approved equal.

B. Provide pressure gauges of materials, capacities, and ranges indicated, designed, and constructed for use in service indicated.

C. Type: General use, 1% accuracy, ANSI B40.1 Grade A phosphor bronze bourbon type, bottom connection.

D. Case: Drawn steel or brass, glass lens, 4-1/2 in. dia.

E. Connector: Minimum 1/2 in. male NPT.

F. Scale: White coated aluminum with permanently etched markings.

G. Range:

1. Typical operating point shall be at mid-range.
2. Scale shall begin at zero and pump shut-off head shall not exceed 90% of upper gauge range.
3. Provide measurement units of psi and/or ft H20.

2.02 PRESSURE GAUGE ISOLATION DIAPHRAGM

A. Manufacturers: Same as for pressure gauges.

B. Provide pressure gauge isolation diaphragm between pressure gauges and process connection on chemical feed and wastewater piping systems.

C. Materials: Teflon isolation diaphragm. 304 SS housing with clean out design.

2.03 ISOLATION VALVE

A. Provide full port true union ball valve between process connection and isolation diaphragm.

B. Verify compatibility of valve materials and process stream.

C. Materials: 304 SS valve housing and connection nipples, unless as otherwise required due to process stream.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which meters and gauges to be installed. Do not proceed with Work until unsatisfactory conditions are corrected.

B. Select pump scale range specific for each application. Verify scale range with Engineer.

3.02 INSTALLATION OF PRESSURE GAUGES

A. Install pressure gauges in piping tee with pressure gauge cock, located on pipe at most readable position.

B. Locations: Install in following locations and elsewhere as indicated:

1. At suction and discharge of each pump provided.

C. Pressure Gauge Cocks: Install in piping tee with snubber.

D. Pressure Gauge Connector Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.03 ADJUSTING

A. Adjust faces of meters and gauges to proper angle for best visibility.

3.04 CLEANING

A. Clean windows of meters and gauges and factory-finished surfaces. Replace cracked or broken windows, repair any scratched or marred surfaces with manufacturer's touch-up paint.

END OF SECTION

SECTION 15123

COUPLINGS, FLANGED COUPLING ADAPTERS, AND SERVICE SADDLES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Couplings, flanged coupling adapters, and service saddles required for piping connections. Some products specified in this Section may not be required for this Contract. Refer to piping system specification section(s) and Drawings to determine particular products to be provided under this Contract.

1.02 SUBMITTALS

A. Not required for products identical to those specified by name of manufacturer and model type.

B. Submit information for products that vary from specified requirements regardless of manufacturer name.

PART 2 PRODUCTS

2.01 COUPLINGS

A. Couplings for connecting plain-end steel or ductile iron pipe of same outside diameter:

1. Dresser Style 38.

2. Smith-Blair Product No. 411.

B. Transition couplings for connecting plain-end steel or ductile iron pipe of different outside diameter:

1. Dresser Style 162.

2. Smith-Blair Product No. 413.

C. Pressure rating shall be greater than test pressure of piping system.

D. Materials:

1. Middle Ring and Gaskets: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.

2. Followers: Ductile iron or steel.

3. Bolts and Nuts: Manufacturer's standard.

2.02 FLANGED COUPLING ADAPTERS

A. Flanged coupling adapters for connecting plain-end steel or ductile iron pipe to flanged pipe, fitting, valve, instrument, or equipment item:

1. Dresser Style 128.

2. Smith-Blair Product No. 913.

B. Pressure rating shall be greater than test pressure of piping system.

C. Materials:

1. Flange: Steel, faced and drilled to 150-lb. class in conformance with ANSI B16.5.

2. Body: Steel.

3. Follower: Ductile iron or steel.

4. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.

D. Bolts and Nuts: Manufacturer's standard.

2.03 SERVICE SADDLES

A. Service saddles for tapping pipe sizes 18 in. and smaller shall be double strap design.

1. Dresser Style 91.

2. Smith-Blair Product No. 313.

B. Service saddles for tapping pipe sizes larger than 18 in. shall be triple strap design.

1. Smith-Blair Product No. 366.

C. Materials:

1. Body: Malleable iron or ductile iron.

2. Straps: Steel.

3. Nuts and Washers: Manufacturer's standard.

4. Gasket: As selected by manufacturer. Suitable for fluid service and maximum operating temperature of piping system.

2.04 FLEXIBLE COUPLE WITH RESTRAINT

A. Plain End Pipe to Flanged Pipe:

1. Manufacturer:

a. Smith-Blair Product No. 912 with Studs.

b. Engineer approved equal.

2. Materials:

a. Body and Flange: Ductile Iron per ASTM A-536.

b. Gasket: Nitrile NSF 61.

c. Bolts and Nuts: Carbon Steel per ASTM A307, Electro galvanized with a di-chromate seal.

d. Studs: Carbon Steel per ASTM A193, Electro galvanized with a dichromate seal.

e. Coating: Fusion bonded epoxy per AWWA C213.

B. Flanged Pipe to Flanged Pipe:

1. Manufacturer:

a. Smith-Blair Product No. 975.

b. Engineer approved equal.

2. Materials:

a. Body: Carbon Steel per ASTM A-53.

b. Follower Flange: Ductile Iron per ASTM A536.

c. Flange: Carbon Steel per AWWA C207 Class D.

d. Gasket: Nitrile NSF 61.

e. Tie Rods: Carbon Steel per ASTM A193.

f. Spigot: Carbon Steel per ASTM A53.

g. Coatings: Fusion bonded epoxy per AWWA C213.

2.05 ANCHORS

A. Provide anchors including, but not limited to, tie rods, lugs, harness assemblies, flanged spool pieces, friction collars and hardware for each coupling, and flanged coupling adapter. Anchors shall restrain pipe to prevent movement out of each coupling and flanged coupling adapter.

B. Design each anchor to sustain force developed by test pressure of piping system.

C. Anchor studs placed perpendicular to longitudinal axis of pipe is unacceptable.

D. Anchorage with welded attachments to ductile iron piping is unacceptable.

2.06 COATINGS

A. Coatings for couplings, flanged coupling adapters, and service saddles shall be same material as coatings for connected pipe.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 15126

RUBBER EXPANSION JOINTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Rubber expansion joints with control units.

1.02 SUBMITTALS

A. Not required for products identical to those specified herein by name of manufacturer.

B. For products other than those specified herein by name of manufacturer, submit manufacturer's standard product literature.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. General Rubber.

B. Garlock.

C. Mercer.

D. Or Approved Equal

2.02 JOINTS

A. Cover, body, seamless tube, and integral full-faced flanges. Standard 125-lb flange drilling.

B. Materials and construction shall be suitable for fluid service, maximum operating temperature, maximum operating pressure and test pressure of piping system.

C. Single arch:

1. Filled for wastewater, sludge, and other fluids with suspended solids.

2. Unfilled for air, clean water and other fluids without suspended solids.

D. Provide control unit for each expansion joint:

1. Gusset plates, washers, bolts, and elastomeric bushings.

2. No metal-to-metal contact to eliminate transmission of noise and vibration.

3. Size control units for maximum operating pressure and test pressure of piping system.

E. Minimum movement capability for single, unfilled arch joints:

Joint Size (in.)	Axial Compression (in.)	Axial Extension (in.)	Lateral Deflection (in.)
6	7/16	1/4	1/2
8 to 18	11/16	3/8	1/2
20 to 24	13/16	7/16	1/2

F. Minimum movement capability for single, filled arch joints shall be at least 50% of movement specified above for unfilled arch joints.

2.03 COATINGS

A. Coatings for valves shall be as recommended by manufacturer. A final field coating shall be applied to match connected piping.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install rubber expansion joints where indicated on Drawings and elsewhere as determined by CONTRACTOR for adequate expansion compensation and vibration isolation of piping systems.

B. Install in accordance with manufacturer's written instructions.

END OF SECTION

SECTION 15155

SANITARY DRAINS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Floor drains
2. Trench drains

1.02 DEFINITIONS

A. ABS: Acrylonitrile-butadiene styrene

B. FRP: Fiberglass-reinforced plastic

C. HDPE: High-density polyethylene

D. PE: Polyethylene

E. PP: Polypropylene

F. PVC: Polyvinyl chloride

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product

PART 2 PRODUCTS

2.01 DRAIN ASSEMBLIES

A. Sanitary drains shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary piping specialty components.

2.02 FLOOR DRAINS

A. Not required.

2.03 TRENCH DRAINS

A. Manufacturer’s

1. Zurn, Model Z874-12 Wide Throat Trench Drainage System
2. Or Approved Equal

B. Specifications:

1. 8” Bottom Outlet.
2. Channels shall be 80" long, 17" wide reveal and have a 12" wide throat.

3. Modular channel sections shall be made of 0% water absorbent High Density Polyethylene (HDPE).

4. Shall have a positive mechanical connection between channel sections that will not separate during the installation and shall mechanically lock into the concrete surround every 10".

5. Channels shall weigh less than 6.6 lbs. per linear foot, have smooth 3.5" radiused self-cleaning bottom with a Manning's coefficient of .009 and 1.00% or neutral 0% built-in slope.

6. Channels are available with inverts ranging from 9.25" to 34.21". Channel shall have all grates locked down.

7. Channels come with clips attached to the frame to accommodate vertical re-bar for positioning and anchoring purposes. Shall be provided with the standard DGC grate, Zurn 16-1/4" wide Ductile Iron Slotted Grate, which locks down to the frame with 4 individual bolt anchors per grate.

8. Ductile Iron conforms to ASTM specification A536-84, Grade 80-55-06. Ductile Iron grate is rated class C per the DIN EN1433 top load classifications.

9. Supplied in 20" nominal lengths with 13/16" wide slots, and 1-3/4" bearing depth.

10. Grate has an open area of 118 sq. in. per ft. The 1/4" thick Carbon Steel Frame Assembly conforms to ASTM specification A36 with 10 - 4" long concrete anchors per 80".

11. The frame is supplied with a powder coated finish. All welds must be performed by a certified welder per ASTM standard AWS D1.1.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install per manufacturer’s recommendations.

B. Install trench drains at low points of surface areas to be drained.

1. Set grates of drains flush with finished surface, unless otherwise indicated.

3.02 CONNECTIONS

A. Install piping adjacent to equipment to allow service and maintenance.

3.03 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

SECTION 15200

PROCESS-MECHANICAL PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section identifies process-mechanical piping systems to be provided, specifies unique requirements for each system identified, and references other sections where detailed requirements of piping components are specified.

B. Process-mechanical piping systems are shown on P&ID and Process-Mechanical Drawings and on Civil Site Piping Drawings. Civil Site Piping Drawings may also show site utility, plumbing, fire protection, and HVAC piping systems which are specified in other sections.

C. Schedule 1 to Section 15200 includes piping schedule which identifies process-mechanical piping systems to be provided. Piping schedule includes application information and specifies unique system requirements, including painting and marking requirements.

1.02 SUBMITTALS

A. Shop Drawings:

1. Layout drawings for each process-mechanical piping system drawn to scale. Identify each piping system with same flow stream identifier as shown on Drawings.

   a. Double-line layout for each piping system 3 in. pipe size and larger. Minimum scale: 1/4 in.=1 ft.

   b. Single-line or double-line layout for each piping system smaller than 3 in. pipe size.

   c. Minimum scale: 1/4 in.=1 ft.

   d. For each piping system include:

      1) Size for each pipe and fitting.

      2) Material, lining type, and system number for coating to be provided for each pipe and fitting.

      3) Pipe class, thickness or schedule for each pipe and fitting.

      4) Pipe end connections (joint type) and couplings.

      5) Location and type of supports, hangers, anchors, and expansion joints.

      6) Pipe couplings, saddles, sleeves, clamps, adapters, and other piping products.

      7) Pipe mounted equipment and instrumentation identified by tag number assigned on Drawings.

      8) Insulation to be provided.

B. Submit in accordance with Section 01330.

PART 2 PRODUCTS

2.01 PIPE AND FITTINGS

A. Provide pipe and fittings as shown on Drawings and as specified in sections identified in Schedule 1 to Section 15200, Process-Mechanical Piping Schedule, presented at end of this section.

2.02 PRODUCTS FOR PIPING SUPPORT, FLEXIBILITY, THERMAL EXPANSION, ANCHORAGE, AND VIBRATION ISOLATION

A. Provide support system for each non-buried process-mechanical piping system in accordance with Section 15060.

B. Provide anchors, restraints, and concrete blocks as required to resist hydraulic thrust and forces due to thermal expansion.

C. Piping system, including support and anchorage system, shall allow for thermal expansion and contraction due to differences in operating temperatures and temperatures piping is exposed to during construction. Provide piping system products to allow for and control movement of piping due to thermal expansion and contraction.

D. No attempt has been made to show all pipe supports, hangers, anchors, expansion joints, and other piping products required for piping support, thermal expansion, and anchorage. Absence of these products on Drawings does not relieve Contractor of his responsibility for providing them in accordance with these Specifications.

E. Provide joints, couplings, and expansion joints as shown on Drawings and as required for piping flexibility and vibration isolation. No attempt has been made to show all joints, couplings, expansion joints, and other piping products required for piping flexibility and vibration isolation.

2.03 OTHER PIPING PRODUCTS

A. Provide couplings, flanged coupling adapters, and service saddles in accordance with Section 15123.

B. Provide piping system identification and pipe markers in accordance with Section 15075.

1. Do not abbreviate flow stream identification on pipe marker.

2.04 COATINGS

A. Coat exterior surfaces of non-insulated piping products with coating system numbers specified in this Section and in accordance with Section 09961.

PART 3 EXECUTION

3.01 PREPARATION

A. Use implements, tools, and facilities for handling and protection of piping products to avoid damage prior to installation.

B. Inspect piping products before installation. Provide new, repair or recondition damaged piping products. Repair or reconditioning is subject to ENGINEER'S approval. Patch damaged interior linings and exterior coatings or replace damaged product with new product. Patching is subject to Engineer’s approval.

C. Clean ends of piping product before installation. Remove foreign matter and dirt from inside of piping product and keep product clean until Work has been accepted.

3.02 INSTALLATION

A. Location:

1. Install piping parallel to structure lines unless shown otherwise on Drawings.

2. Do not install piping through beams, columns, or other structural members unless shown on Drawings.

3. Locate valves in piping system in accordance with manufacturer's instructions. In horizontal piping runs, do not orient valves so operating stem is below horizontal centerline unless specifically noted on Drawings to do so.

B. Assembly:

1. Install piping without springing or forcing in manner which would cause stress in piping, valves, or connected equipment.

2. Set pipe flanges level, plumb, and aligned. Set flanged fittings so flange is true and perpendicular to pipe axis. Set flanges so bolt holes straddle vertical centerline of pipes.

3. For flanged connections, match bolt holes and obtain uniform contact over entire flange area prior to installation of flange bolts. Tighten bolts to uniformly compress gaskets and minimize flange stress. Tighten bolts to torque recommended by gasket manufacturer. Coat nuts and bolts with anti-seize thread compound.

4. Machine off raised-face of steel flange when mating with flat-faced flange.

C. Pump, Blower and Equipment Connections:

1. Align pipe, equipment, pumps, and blowers so stresses are not transmitted to connections. Support piping independently from pumps, blowers, and equipment. Do not support piping from equipment, blowers, and pumps. Anchor piping to prevent transmission of hydraulic thrust load to pumps, blowers, and equipment.

2. Install couplings, adapters, expansion joints, flanges, and unions so pumps, equipment, valves, and in-line instruments can be removed from service without disruption to other portions of piping system.

3. Install couplings, expansion joints and other vibration isolation components to isolate piping from pump, blower, and equipment vibration.

4. For welded nozzle connections, allow for shrinkage during welding to prevent excessive stresses on pumps and equipment.

5. Provide piping from pump and equipment drains and overflows to floor drain system.

6. Provide control lines such as air and bubbler level system piping necessary for operation of pumps, equipment, valves, and in-line instruments.

D. Install insulating flange, insulating coupling or dielectric union at each connection between ferrous and non-ferrous metal piping.

3.03 FIELD QUALITY CONTROL

A. Inspect installed piping products for dents, kinks, abrupt changes of curvature, damage to lining, and other damage. Repair or recondition damaged products as approved by ENGINEER or replace damaged products with new products.

B. Inspect installed, unlined piping products for corrosion and scale on interior surfaces. Clean products to remove corrosion and scale or replace with new products.

C. Test system in accordance with Section 01457 and specified in Schedule 1 to Section 15200.

3.04 CLEANING

A. After installation and before testing, remove dirt, rocks, debris and other foreign matter from interior of each piping system.

B. Water flush each hydrostatically tested piping system unless specified otherwise.

1. Flushing velocities of 2.5 ft per sec shall be maintained until accumulated debris has been removed.

2. Insert cone strainers at equipment connections prior to flushing. Remove cone strainers after flushing is complete.

3. Remove accumulated debris through drains not less than 2 in. in dia or by temporarily removing pipe spools, fittings, or valves.

4. Drain piping after flushing and immediately dry piping with compressed air.

3.05 PROCESS MECHANICAL PIPING SCHEDULE

A. SERVICE column: Presents Flow Stream Identifiers for process-mechanical piping systems.

1. Civil Drawings may also show site utility, plumbing, fire protection, and HVAC piping systems which are not included in Process-Mechanical Piping Schedule. Site utility, plumbing, fire protection, and HVAC piping systems are specified in other sections.

B. SIZE column: Presents nominal pipe diameter(s) for each piping system shown on P&ID's and Process-Mechanical Drawings and continuation of piping system on Civil Drawings.

C. PIPE MATL column: Identify material type to be provided for piping system. Piping material shall conform to requirements of referenced sections:

Pipe Material	Section	Abbreviation in Piping Schedule
Copper Piping	See Plumbing Drawings	COP/CT
Welded Steel Piping	15011	STL
Ductile Iron Piping	15012	DI
304L Stainless Steel Piping	15013	304SS
Polyvinyl Chloride Piping	15018	PVC

D. LOCATION Column: Identifies installation location of piping system. Piping system components shall be suitable for condition specified.

E. MIN/MAX TEMP column: Presents minimum and maximum operating temperature of piping system. Piping system components shall be suitable for operating temperatures shown.

F. MAX PRESSURE column: Presents maximum operating pressure of piping system and type of test to be provided. Piping system components shall be suitable for maximum operating pressure shown and test pressure specified.

1. Provide hydrostatic testing in accordance with Section 01457 where maximum operating pressure value is followed by "-H".

2. Test pressure for hydrostatic testing shall be 1.5 times maximum operating pressure, minimum, unless specified otherwise in REMARKS column. Test pressure for low pressure air testing shall be as specified in Section 01457.

3. If maximum operation pressure is followed by "-none", no test required.

G. COLOR column: Specifies color coding and banding to be provided for non-buried piping systems. Provide color coding, banding, and labeling in accordance with Section 15075.

Wastewater Facilities	
Sewage	Dark Gray
Wastewater Effluents	Light Gray
Sludge	Dark Brown, Light Brown
Natural Gas	Orange
Digester Gas	Orange with Brown Band
Potable Water, W1	Dark Blue
Non-Potable Water, W2	Dark Blue with Yellow Band
Plant Effluent, W3	Light Gray
Flushing Water, W3	Light Gray
Chlorine and Hypochlorite	Yellow
Air Low Pressure	Dark Green
Air High Pressure	Dark Green with Red Band
Chemicals	Yellow, Light Green (Provide Banding if Project Has Multiple Chemicals)
Drain	Black
Vent	Black

H. REMARKS column: Provides further description of piping system and specifies additional requirements.

I. If process mechanical piping shown on Drawings is not listed in schedule, CONTRACTOR shall provide piping.

1. Provide type of pipe used in similar services on project.
2. Provide piping suitable for pressure, temperature and other service conditions.
3. Submit type of pipe proposed for review by Engineer.

SCHEDULE 1 TO SECTION 15200

PROCESS MECHANICAL PIPING SCHEDULE WITHIN STRUCTURES / BUILDINGS

Service	Size (in.)	Pipe Matl	Location	Min/Max Temp (F)	Max Press (psig)	Color	Remarks
BLDG. NO. 8 - INFLUENT PUMPING							
RWW	4, 6 & 10	CLDI	Inside Exposed	40/110	100-H	Dk. Gray	New and Existing Piping

END OF SECTION

SECTION 16000

ELECTRICAL GENERAL PROVISIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Applicable provisions of Bidding Requirements, Project Guidelines and General Requirements (Div. 1) apply to work specified in this Section.

1.02 DESCRIPTION

A. Work Included:

1. This Section includes all labor, materials, equipment, tools, supervision, start-up services, and Owner's instructions, including all incidental and related items necessary to complete installation and successfully test, start-up and operate in a practical and efficient manner, all electrical work and systems indicated on the drawings and described in each Section of Division 16 and conforming to all contract documents.

2. This Section defines certain terms used in these specifications and explains the language, abbreviations thereof, format and certain conventions used in the specifications and certain associated contract documents.

3. The following are not intended to supersede but to clarify the definitions used in the General Requirements (Division 1).

B. Site and Contract Document Examination: Submission of a Bid Proposal is considered to be evidence that the Contractor has visited the site, examined the drawings and specifications of all the trades and has fully informed himself as to all project and site conditions and is proficient, experienced and knowledgeable of all standards, codes, ordinances, permits and regulations which affect every trade's completion, cost and time required and that all costs are included in his Bid Proposal.

C. Responsibility:

1. The Contractor shall be responsible for all subcontractors and suppliers and shall include in his bid and apportion all materials, labor and equipment to the several trades involved in accordance with all local customs, rules, regulations, jurisdictional awards, decisions and secure compliance to all parts of the specifications and drawings regardless of sectional inclusion in these specifications.

2. Each electrical subcontractor and sub-subcontractor shall be responsible for all parts applicable to his trade in accordance with the specifications and drawings and for coordinating locations and arrangements of his work with all other relevant specifications, drawings, shop drawings and details.

D. Drawings and Specifications:

1. Drawings and specifications are intended to supplement each other and all work specified or indicated on/in either shall be provided.

2. Drawings are diagrammatic and indicate general arrangements of systems and work included in the contract and shall serve only as design drawings and not as

working drawings for general layout of various equipment and systems. Drawings do not necessarily indicate every required offset, junction box, pull box, mounting support, access panel, etc. which shall be provided as required.

3. Each subcontractor shall examine all drawings and specifications of his trade and drawings, shop drawings and field layouts of work of all other trades working on the project, including architectural, structural and mechanical. If any discrepancies occur between these various drawings or between these drawings and these specifications, he shall report same to the Engineer in writing and shall obtain written instructions for changes in construction.

4. Should interferences develop during construction which cannot be avoided, the Engineer shall decide which work is to be relocated regardless of which was first installed. This work shall be performed at no extra cost to the Owners.

5. Should drawings disagree in themselves or with the specifications, the better quality or greater quantity of work shall be provided.

6. All schedules on the drawings or in the specifications are only for the convenience of the Contractor. The Contractor shall make his own count and, where fixtures and/or equipment are indicated on the drawings but not in the schedules, the Contractor shall provide like equipment and/or fixtures as are indicated for like rooms or used elsewhere on the project.

7. Manufacturer's Model Numbers:

   a. Wherever, on the drawings or specifications, that a manufacturer's catalog number of model or type designation is made, it is intended as a general qualification. It shall remain the Contractor's responsibility, before the ordering of any material, to determine the proper type or model with arrangement, mounting and accessories applicable for each location on the project.

   b. Approval of shop drawings by the Engineer does not obviate the Contractor's responsibility.

8. Drawings shall not be scaled for measurements and shall not serve as shop drawings.

E. Definitions:

1. Furnish: Supply and deliver to the project site, ready for unloading, unpacking, assembly, installation and similar subsequent requirements.

2. Install: Operations at the project site, including unloading, unpacking, assembly, erection, placing, anchoring applying, working to dimension, finishing, protection, cleaning and similar requirements.

3. Provide: Furnish and install, complete and ready for the intended use.

4. Minimum Requirements:

   a. Indicated requirements are for a specific minimum acceptable level of quality as recognized in the industry. Actual work must comply, within specified tolerances, or may exceed minimums within reasonable limits.

   b. Refer uncertainties to the Engineer for decisions before proceeding.

5. Abbreviations and Plural Words:

   a. Abbreviations, where not defined in the contract documents, will be interpreted to mean the normal construction industry terminology determined by recognized grammatical rules by the Engineer.

   b. Plural words will be interpreted as singular and singular words will be interpreted as plural where applicable for the context of the contract documents.

6. Raceway: Conduit, wireway, channels, boxes, fittings, hangers, supports and items necessary or required in connection with and/or relating to raceway to provide a complete installation.

7. Concealed: Embedded in masonry or other construction below floor slabs, installed behind wall finishes, within double partitions or above hung ceilings, in trenches, tunnels or crawl spaces.

8. NIC: Items and/or areas shown on the drawings or identified within these specifications with "NIC" shall be considered by this Contractor as "Not In Contract". As a result, this Contractor shall take no action on those items identified as such.

F. Substitutions and Changes:

1. When a material, method or product is listed, shown or scheduled by trade name or catalog number for a use, it shall be the basis of design. Other "similar" manufacturers may or may not be listed as "acceptable", provided that the specific item is comparable with the basis and intent of the design.

2. Contractors shall base their bid proposals only on those items either:

   a. Originally named, listed, shown or specified on/in the drawings/ specifications.

   b. Named, listed, and/or shown in an official addendum to the drawings/specifications. All other manufacturers or catalog numbers shall be bid as a voluntary alternate only. Any Contractor choosing to base his bid proposal on any item and/or system not either originally named or named in an official addendum as "acceptable" does so at his own risk and may be required to furnish and install the originally named product and, if applicable, bear all of the costs involved with removing the unauthorized product.

3. Contractor shall be considered liable for all added costs both to himself and to others (including those costs as incurred by the Engineer for redesigning or redrawings) resultant from the substitution of products not originally specified.

4. Contractor shall be responsible for the verification of adequate space (considering dimensions, required clearances, weights and roughing-in requirements) for the installation of any items or systems not originally specified. He shall be responsible for the timely advising of all other trades. He shall submit revised drawing layouts for the approval of the Engineer and shall not proceed without this approval.

1.03 STANDARDS, CODES AND PERMITS

A. General: Compliance with standards, codes and permits shall be in accordance with General and Supplemental Conditions.

B. Electrical Work: All work installed under Division 16 shall comply with the latest published edition of the applicable standards and codes of the following:

1. ASA....American Standards Association
2. ASTM...American Society for Testing Materials
3. ANSI...American National Standards Institute
4. NFPA...National Fire Protection Association
5. UL.....Underwriter's Laboratories, Inc.
6. NEMA...National Electrical Manufacturer's Association
7. NESC...National Electric Safety Code
8. OSHA...Occupational Safety and Health Act
9. BOCA...Building Officials and Code Administrators
10. UBC....Uniform Building Codes
11. NEC....National Electrical Code
12. NECA...National Electrical Contractors Association
13. NEMA...National Electrical Manufacturer's Association

C. All labor, material and equipment shall comply with all applicable:

1. City, county and state laws, ordinances, codes and regulations.
2. Applicable rules and regulations as required by the Department of Consumer and Industry Services – Fire Safety Division.

D. Excess Quantities and Sizes: Where quantities, sizes or other requirements on drawings or in specifications are in excess of code requirements, drawings or specifications shall govern and the specified item or system shall be furnished and installed.

E. Conflicts: Where conflicts are discovered to exist between referenced standards or specifications, the more stringent requirements shall govern. No extra compensation for such compliance will be allowed.

F. Notices and Payments: The Electrical Contractor shall give all notices, file all drawings, obtain all necessary approvals, obtain all permits, pay all fees, deposits and expenses required for installation of all work under this contract. Within ten (10) days after award of the contract, the Contractor shall show proof that such permits have been obtained and appropriate fees paid.

G. Inspections and Certificates of Inspection:

1. No work shall be covered or enclosed until work is tested in accordance with applicable codes and regulations and successful test witnessed and approved by authorized inspection authority.

2. Provide for the Engineer's review evidence that the installation has been inspected and approved by the authorized governmental inspector having jurisdiction over that phase or system of work involved.

H. UL Labels: In general, all material used on this project shall be labeled or listed by Underwriter's Laboratories, Inc.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Delivery, storage, and handling shall be in accordance with the General and Supplementary General Conditions.

B. Inspection: Inspect all items upon delivery and remove and replace all items impossible to repair so that they are equal and indistinguishable from new items.

C. Protection: Protect electrical materials and products and installation work against dirt, water, or mechanical damage before, during, and after installation.

D. Repairs: All damage inflicted prior to date of final acceptance shall be repaired or replaced in a manner acceptable to the Engineer at no cost to the Owner by the Contractor or Subcontractor whose work is involved.

1.05 STANDARDS

A. General:

1. All electrical material, equipment, and accessories installed under this project shall be new and shall conform to all applicable standards, requirements, and codes and all applicable local, state, and federal specifications.

2. All products shall be of established manufacturers regularly engaged in the making of the type of materials to be provided. All products shall be complete with all parts, accessories, supports, trims, connections, etc., reasonably incidental to the product and necessary for installation.

3. All products shall be properly tested, cleaned, adjusted, and put in complete working order ready for service before acceptance will be considered.

4. All electrical work shall be installed in a first-class workmanlike manner.

5. Due to the difficulty in showing the exact locations on the drawings of all raceways, offsets, boxes, fittings, or accessories, coordinate the installation with all trades and, where conflicts occur, obtain the Engineer’s approval before installation. Failure to do this shall result in rework to meet the Engineer’s approval at no additional cost to the Owner’s or Engineer’s.

6. All conductor and raceway sizes shall meet National Electrical Code (NEC) requirements.

1.06 INSPECTION AND PREPARATION

A. General:

1. Perform inspections in accordance with Division 1, Coordination and Inspections.

2. Prior to starting his work, the Electrical Contractor shall:

a. Examine all conditions of all areas in which his work is to be installed.

b. Verify all dimensions indicated of the drawings.

c. Make all field measurements required for his work.

d. Report, in writing to the Engineer, any and all discrepancies or required corrections.

3. Do not proceed with the work until acceptable conditions have been provided.

4. The commencement of work by the Electrical Contractor shall signify the Electrical Contractor's acceptance of all existing conditions.

B. Laying Out of the Work:

1. Lay out work and be responsible for lines, elevations, and measurements for installation of the work. Construct work in conformity with lines and elevations as indicated on the drawings.

2. Record all data on project record documents set.

1.07 BASIC INSTALLATION METHODS

A. Equipment Clearance: Coordinate mechanical and electrical equipment locations to ensure that adequate clearance for installation, inspection, and required service is provided. Ensure that adequate clearance is maintained around equipment as required by the National Electrical Code and all applicable state and local codes.

B. General Supports: Provide all necessary angles, channels, brackets, or Unistrut supplementary steel as required for adequate support of all raceway, specialties, and equipment which is hung or mounted above the floor. Secure written approval from the Engineer before welding or bolting to steel framing or anchoring to concrete structure.

C. Wall, Floor, and Ceiling Openings:

1. Place all sleeves and advise affected trades of details and templates of all openings necessary for the installation of the electrical work.

2. Cracks and rough edges left following installation of the equipment shall be caulked, covered, or repaired to the satisfaction of the Engineer.

3. Floor sleeves shall be rigid galvanized steel conduit with the bottom end flush and caulked with glass wool; sealed at the top and bottom.

4. Wall sleeves shall be the same as floor sleeves except that they shall be installed so as to be flush on both sides of the wall.

5. All sleeves shall have an inside diameter one (1) inch larger than the outside diameter of the raceway passing through them.

6. Where exposed pipes pass through floors, walls, or ceilings, this contractor shall be responsible for repairs and finish of all holes placed.

7. All conduits penetrating through slabs shall be waterproofed and sealed to prevent the transfer of water. Use a grout mixture to seal the concrete or "Duxseal" to seal the sleeves.

D. Cutting and Patching:

1. Cutting and patching shall be in accordance with Division 1, Cutting and Patching, and this section.

2. Cutting and patching required by the installing Contractor or Subcontractor shall be performed by the installer under the direct supervision of the General Contractor. Patching shall be, in general, to the same standards of finish and appearance as the adjacent undisturbed material. Should it be necessary to achieve this condition, the installer shall employ those specialty workmen as may be required at no additional cost to the Owners.

E. Protection:

1. Each Contractor or Subcontractor shall protect his work, fixtures, equipment, and materials at all times and be responsible for all damages caused either directly or indirectly by his workmen or by project conditions.

2. All raceway openings shall be kept tightly closed with caps or plugs (not paper) during installation whenever openings are left unattended.

F. General Cleaning:

1. It shall be the duty of this Contractor to keep the premises free of accumulations of surplus material or rubbish caused by his operations and/or the operations of his Subcontractors. Combustible rubbish and debris shall be removed immediately. The trades shall remove their rubbish and debris from the project site promptly upon its accumulation; in no event later than the Friday of each week.

2. Upon completion of the installation, the Contractor shall thoroughly clean all fixtures, equipment, boxes, and raceways.

3. All patching, repairing, and painting required of surfaces damaged or allowed to deteriorate in the performance of this work made by this Contractor, where directed by the Engineer, at this Contractor’s expense.

4. If a Contractor does not remove rubbish or clean the systems as specified above, the Construction Manager reserves the right to have the work performed by others, with the cost back-charged to the Contractor who made the removal or cleaning necessary.

5. Clean all fixtures, boxes, controls, devices, cabinet interiors, enclosures, and other applicable equipment and accessories free of all foreign material.

1.08 FINAL ACCEPTANCE, GUARANTEES AND WARRANTIES

A. General: Final acceptance of the systems, guarantees and warranties shall be in accordance with General Conditions (Division 1), this section and other applicable sections.

B. Final Acceptance: Final acceptance of the systems will be made only after final punch list completion and receipt at the Engineer's office of:

1. All guarantees and/or warranties.

2. Operating and maintenance instructions.

3. Record drawings.

4. Certificates of Inspection.

C. Guarantees and Warranties: Guarantees shall be in accordance with the applicable specification section and the following:

1. All labor, materials and equipment shall be guaranteed by the Contractor and/or warranted by the manufacturer for one (1) calendar year after date of final acceptance, except where specific, longer periods are specified. Contractor shall secure such warranties from all suppliers.

2. Acceptance data of substantial completion or Owner occupancy shall be as determined by Engineer. See "General Requirements" Division 1.

3. Make all necessary alterations, repairs, adjustments and replacements during guarantee period as directed by Engineer to comply with drawings and specifications. Such work shall be at no cost to the Owner.

4. Repair or replacements made under guarantee shall bear one (1) year extended guarantee from date of acceptance of repair or replacement.

1.09 SUPERVISION

A. This Contractor shall have in charge of the work at all times during construction a thoroughly competent Field Superintendent with long experience in the work to be installed under this contract.

B. Any person not deemed capable by the Engineer shall be replaced immediately, upon the request of the Engineer, by some person who is satisfactory to the Engineer. After such person has been assigned, he shall not be withdrawn or reassigned without the consent of the Engineer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

END OF SECTION

SECTION 16050

BASIC MATERIALS AND METHODS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Raceway Systems.
2. Wire, Cables and Connectors.
3. Wiring Devices.
4. Motor Starters.
5. Motor and Circuit Disconnects.
6. Fuses.
7. Panel boards.
8. Mini-Power Centers.

1.02 SUBMITTALS

A. Approval of equipment supplied in this section is contingent upon CONTRACTOR verification of available fault current from electric utility.

1. Notify ENGINEER if available fault current is higher than specified equipment.

B. Product Data:

1. Submit for disconnects, motor starters, panel boards, circuit breakers, overcurrent protective devices, and mini-power center.
2. Product data sheets with printed installation instructions.

C. Shop Drawings:

1. Submit for motor starters.
2. Show enclosure dimensions, nameplate nomenclature, electrical ratings, and thermal unit schedule.
3. Wiring diagrams and schematics.

D. Operation and Maintenance (O&M) Data:

1. Maintenance data for materials and products for inclusion in Operating and Maintenance Manual.

E. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

A. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

B. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.01 METAL CONDUIT AND TUBING

A. Galvanized Rigid Steel Conduit: ANSI C80.1.

B. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.

C. Electrical Metallic Tubing and Fittings: ANSI C80.3 with compression-type fittings.

D. Flexible Metal Conduit: Zinc-coated steel.

E. Liquidtight Flexible Metal Conduit: Flexible steel conduit with PVC jacket.

2.02 NONMETALLIC CONDUIT

A. Rigid Nonmetallic Polyvinyl Chloride (PVC) Conduit: NEMA TC 2, Schedule 40 or 80 PVC.

2.03 FITTINGS

A. Fittings for steel conduits:

1. Steel or malleable iron, zinc galvanized or cadmium plated.

2. Do not use set screw or indentor type fittings.

3. Do not use aluminum or die cast fittings.

4. EMT and GRS Connectors and Couplings:

a. Threaded.

b. Insulated throat.

c. Gland compression type.

d. Rain and concrete type.

5. Comply with ANSI C80.4.

6. Comply with NEMA FB 1, compatible with conduit materials.

B. Conduit bodies:

1. Malleable iron with galvanized finish.

C. Fittings for flexible metal conduit:

1. Insulated throat type.

2. Threaded.

3. Grounding type.

4. Liquidtight: 1 piece sealing "O" rings with connectors when entering boxes or enclosures.

D. PVC Conduit Fittings:

1. EMA TC 3; match to conduit type and material.

E. Expansion Joints:

1. Conduit expansion fittings complete with copper bonding jumper, Cooper Crouse-Hinds Type XJ.

2. Conduit expansion/deflection fittings with copper bonding jumper, Cooper Crouse-Hinds Type XD.

2.04 WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.

B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireway as required for complete system.

C. Select features where not otherwise indicated, as required to complete wiring system and to comply with NEC.

D. Wireway Covers:

1. Hinged type for dry locations.

2. Bolted cover with gasket for wet locations.

E. Finish: Manufacturer's standard enamel finish unless otherwise noted.

2.05 BOXES

A. Of indicated types, sizes and NEMA enclosure classes. Where not indicated, provide units of types, sizes, and classes appropriate for use and location. Provide items complete with covers and accessories required for intended use. Provide gaskets for units in damp or wet locations.

B. Fasteners:

1. General Use: Corrosion resistant screws and hardware including cadmium and zinc plated items.

2. Damp or Wet Locations: Stainless steel screws and hardware.

C. Outlet Boxes:

1. Boxes shall be of type, shape, size, and depth to suit each location and application.

2. Cast Boxes: Iron alloy, waterproof, with threaded raceway entries and features and accessories suitable for each location, including mounting ears, threaded screw holes for devices and closure plugs.

D. Pull and Junction Boxes:

1. Boxes shall have screwed or bolted on covers of material same as box and shall be of size and shape to suit application.

2. Stainless-Steel Boxes: Fabricate of stainless steel conforming to Type 304 of ASTM A167. Cover shall be gasketed.

3. Galvanized Cast-Iron Boxes: Molded of cast iron alloy with gasketed cover and integral threaded conduit entrances.

2.06 WIRES, CABLES, AND CONNECTORS

A. Building wires and cables with insulation type, cable construction, and rating as required to meet application and NEC requirements.

B. Manufacturers:

1. Wire and Cable:

a. Southwire.

b. Houston Wire and Cable.

c. Belden.

d. American Insulated Wire Corp.

e. Republic Wire.

f. Superior Essex.

2. Connectors:

a. FCI-Burndy.

b. Thomas and Betts.

c. Blackburn, Thomas, and Betts.

C. Copper wire only.

D. 600 v insulation (ASTM standard compounds) and color code conductors for low voltage (secondary feeders and branch circuits) as required by NEC.

1. Type THWN Stranded: Single conductor No. 12 AWG minimum for branch circuit and feeder conductors size No. 8 AWG and smaller.

2. Type XHHW Stranded: Single conductor for branch circuits, feeders, and service conductors larger than No. 8 AWG.

3. Provide grounding conductor when run with circuit conductors with same insulation as circuit conductors.

4. Type THWN Stranded: Single conductor No. 12 AWG minimum for 120 v control wiring and No. 14 AWG minimum for graphic indication, nonshielded instrumentation and other control wiring operating at less than 120 v unless otherwise noted on Drawings.

a. Provide high density polyethylene jacket on cables installed below ground and in duct encasements.

E. Joints, Taps, and Splices:

1. Joints, Taps, and Splices in Conductors No. 10 AWG and Smaller: UL listed preinsulated compression spring-type solderless connectors.

2. Joints, Taps, and Splices in Conductors No. 8 AWG and Larger: Solderless 2 or 4 -bolt compression type connectors of type that will not loosen under vibration or normal strains.

F. Terminations:

1. Power Conductors: Compression crimp type lugs.

2. Control and Instrumentation Conductors: Compression crimp type fork tongue, insulated support type lugs on terminal strips. Do not splice.

2.07 WIRING DEVICES

A. Manufacturers:

1. Hubbell Wiring Device Division.

2. Pass and Seymour/Legrand.

3. Appleton Electric Company.

4. Cooper Crouse-Hinds Company.

B. Color: Ivory unless otherwise indicated or required by NEC.

C. Switches:

1. General Use Lighting Switches: 20 amp toggle, equal to Hubbell No. 1221-I series.

2. Switches controlling equipment, operation of which is not evident from switch position, shall include flush neon pilot light in conjunction with proper switch. Each switch shall be complete with engraved plate to identify equipment being controlled (white letters on black, 1/8 in. high minimum).

D. Ground-Fault Circuit Interrupter Receptacles (GFCI).

1. Ratings: 120 vac., 20 amp.

2. Tripping Requirement: UL Class A.

3. Construction:

a. Shallow depth.

b. Line and load terminal screws.

c. Noise suppression.

d. Feed through.

e. Standard duplex wall plates shall fit.

f. NEMA 5-20R configuration.

4. Meet requirements of UL 943 ground-fault circuit interrupters.

E. Wiring Device Plates and Covers:

1. Weatherproof plates and covers suitable for wet locations while in use.

a. Hinged and gasketed cover/enclosure to maintain weather tight seal while the equipment is plugged into it. TayMac or equal.

2.08 MOTOR STARTERS

A. Manufacturers:

1. Siemens.

B. Enclosures:

1. NEMA 4X stainless steel with watertight hubs for outdoor and wet locations.
2. As otherwise indicated and as required by NEC.

C. Magnetic Starters:

1. Minimum short circuit withstand rating in combination with motor circuit protective device shall be 22,000 symmetrical amps or as indicated on Drawings.

D. Magnetic Motor Starter Construction:

1. Full voltage, nonreversing, across the line, unless otherwise indicated.
2. Mounted in vertical position, gravity dropout.
3. Double break silver alloy contacts.
4. Molded coil.
5. Contacts and coil replacement without removing starter from enclosure or power wiring from starter.
6. Straight-through wiring.
7. Overload Relay:
    a. Electronic solid state type with inverse-time-current characteristic, phase loss and phase unbalance protection for size 2 and larger.
    b. 1-piece thermal unit construction for size 1.
    c. 1 melting alloy type overload relay per phase, manually reset.
    d. Interchangeable thermal units.
    e. Thermal units must be in-place to operate starter.
    f. Replaceable overload relay circuit contacts.
    g. NEMA Class 20 heaters or sensors in each phase matched to nameplate full load current of motor, unless otherwise indicated.
8. Overload relay submersible pumps and hermetically sealed motors.
    a. Same as above except NEMA Class 10 heaters or sensors.
9. NEMA standards for size and hp rating.
10. NEMA Size 1 minimum.

E. Combination Starter:

1. Combination Starters:
    a. Motor circuit protector type.
    b. Three-pole, three-phase NEMA size as indicated with three melting alloy or solid state overload relays.

c. Hand-Off-Auto selector switch.

F. Control Circuits:

1. Voltage not to exceed 120 v.
2. Control transformer mounted in starter enclosure.
3. Fuses on one secondary line.
4. One secondary line grounded.
5. Transformer sized for device, accessories connected thereto, and 25% extra capacity minimum.

G. Controls:

1. Reset button mounted in enclosure cover.
2. Heavy-duty, oil-tight green push to test pilot lights mounted in enclosure cover.
3. Heavy-duty, oiltight pushbuttons and selector switches mounted in enclosure.

2.09 MOTOR AND CIRCUIT DISCONNECTS

A. Manufacturers:

1. Siemens.

B. Enclosed Circuit Breaker Construction:

1. Dual cover interlock.
2. External trip indication.
3. Provisions for control circuit interlock.
4. Padlock provisions for padlock in On and Off position.
5. Handle attached to box, not cover.
6. Handle position indicates On, Off or Tripped.
7. Provisions for insulated or groundable neutral.

C. Permanent Trip Circuit Breakers:

1. Thermal and magnetic protection.
2. Magnetic protection only in combination with motor starters and motor circuit protectors (MCP).
3. Single magnetic trip adjustment.
4. Single-handle common trip, 2 and 3 poles (handle ties not acceptable).
5. Push-to-trip test button.
6. Bolt-on type.
7. Quick make and break toggle action.
8. Handle trip indication.
9. Handle position indication, On, Off, and Tripped centered.
10. UL listed for type of wire specified.

11. UL listed short circuit rating (integrated equipment rating).
    a. Up to 240 v: 22,000 RMS symmetrical amp minimum.
    b. Up to 480 v: 18,000 RMS symmetrical amp minimum.

D. Safety Switches:
1. NEMA heavy duty Type HD.
2. Dual cover interlock.
3. Visible blades.
4. Provisions for control circuit interlock.
5. Pin type hinges.
6. Tin plated current carrying parts.
7. Quick make and break operator mechanism.
8. Handle attached to box, not cover.
9. Handle position indication, On in up position and Off in down position.
10. Padlock provisions for up to 3 padlocks in On and Off position.
11. UL listed lugs for type and size of wire specified.
12. Spring reinforced fuse clips for Class R fuses.
13. Provisions for insulated or groundable neutral.
14. UL listed short circuit rating 200,000 RMS amp with Class R fuses.

E. Enclosures:
1. NEMA 4X stainless steel with watertight hubs for outdoor and wet locations.
2. As otherwise indicated and as required by NEC.

2.10 FUSES

A. Manufacturers:
1. Cooper Bussmann.
2. Ferraz Shawmut.
3. Littelfuse.

B. 250 v Fuses:
1. Class RK 1, 1-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000 amp interrupting rating.
    a. Bussmann Low-Peak. LPN-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder, and main service protection.

C. 600 v Fuses:
1. Class RK 1, 1-end rejection or to fit mountings specified, 1/10 to 600 amps, 200,000 amp interrupting rating.

a. Bussmann Low-Peak. LPS-R, dual element, time delay with short circuit protection for motor, transformer, welder, feeder and main service protection.

2. Class L, bolt-in, 601 to 6,000 amps, 200,000 amp interrupting rating.

a. Bussmann HI-CAP. KRP-C, time delay for overload and short circuit protection for motor, transformer, feeder, and main service protection.

3. Class CC, fast acting, single element, 1/10 to 30 amps, 200,000 amp interrupting rating.

a. Bussmann Limitron. KTK-R, UL listed for motor control circuits, lighting ballasts, control transformers, and street lighting fixtures.

D. Spare Fuses:

1. 10%, minimum of 3, of each type and rating of installed fuses.

2.11 MINI-POWER CENTER

A. Manufacturers:

1. Siemens.

B. Materials and Equipment:

1. UL listed, 10,000 AIC rated.
2. NEMA 3R enclosure with padlock provision.
3. 480 v, 20 A, 3-pole single phase primary main circuit breaker.
4. 5 kVa 480-120/240 v encapsulated core and coil assembly.
5. 240 v, 25 A, 2-pole single phase secondary main circuit breaker.
6. 4-20 A, single pole branch circuit breakers as indicated.
7. Neutral bar grounded to case.
8. Ground bar with terminals.

PART 3 EXECUTION

3.01 RACEWAY SYSTEMS

A. Outdoors, Damp or Wet Locations: Use following wiring methods unless otherwise noted on Drawings:

1. Exposed: Galvanized rigid steel.
2. Underground Power: Rigid nonmetallic (PVC) schedule 40 conduit.
3. Connection to Vibrating Equipment (including transformers and hydraulic, pneumatic, or electric solenoid or motor-driven equipment): Liquidtight flexible metal conduit.

B. Use 3/4 in. minimum trade size conduit unless otherwise noted.

C. Examine surfaces to receive raceways, wireways, and fittings for compliance with installation tolerances and other conditions affecting performance of raceway system.

D. Coordinate layout and installation of raceway and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

E. Complete conduit installation prior to installing cables.

F. Raceway systems shall be continuous from outlet to outlet and from outlets to cabinets, junction or pull boxes.

G. Enter and secure to boxes ensuring electrical continuity from point of service to outlets.

H. Conduit shall be run concealed except exposed surface conduit may be installed where noted on Drawings or where concealment found to be impractical or impossible, and only with approval of ENGINEER.

I. Provide watertight conduit system where installed in wet places, underground.

1. Use threaded hubs when entering top of enclosures.

2. Use sealing type locknuts when entering sides or bottom of enclosures.

J. Conduit runs extending through areas of different temperature or atmospheric conditions or partly indoors and partly outdoors shall be sealed, drained, and installed in manner preventing drainage of condensed or entrapped moisture into cabinets, motors or equipment enclosures.

K. Cap conduits after installation to prevent entry of debris.

L. Connections to motors and equipment subject to vibration shall be maximum of 3 ft long. Locate where least subject to physical abuse.

M. Install conduit expansion fittings complete with bonding jumper in following locations.

1. Conduit runs crossing structural expansion joint.

2. Conduit runs attached to 2 separate structures.

3. Conduit runs where movement perpendicular to axis of conduit may be encountered.

N. Install separate ground conductor inside flexible conduit connections.

O. Transition duct conduit to galvanized rigid steel conduit before rising above grade. Wrap with plastic tape to provide 40 mil thick cover to height of 6 in. above grade.

P. For conduits containing fiber optic cables, provide conduit bends with minimum radius of 20 times cable diameter.

3.02 BOXES

A. Cap unused knockout holes where blanks have been removed and plug unused conduit hubs.

B. Support and fasten items in accordance with Section 16070.

C. Do not burn holes, use knockout punches or saw.

D. Provide outlet box accessories as required for each installation such as mounting brackets, fixture studs, cable clamps, and metal straps for supporting outlet boxes compatible with outlet boxes being used and meeting requirements of individual wiring situations.

E. Sizes shall be adequate to meet NEC volume requirements, but in no case smaller than sizes indicated.

F. Location of outlets and equipment shown on Drawings is approximate. Verify exact location.

G. Minor modification in location of outlets and equipment is considered incidental up to distance of 10 ft with no additional compensation, provided notification of modification is given prior to roughing in of outlet.

H. Outlet Boxes and Fittings: Install outlet and device boxes and associated covers and fittings of materials and NEMA types for each location in conformance with following requirements unless otherwise noted on Drawings:

1. Wet Locations: Stainless Steel, NEMA type 4X enclosures.

2. Corrosive Locations: Stainless Steel, NEMA type 4X enclosures.

I. Pull and Junction Boxes: Install pull and junction boxes of materials and NEMA types suitable for each location.

3.03 WIRE AND CABLE

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA "Standard of Installation".

B. Run wire and cable in conduit unless otherwise indicated on Drawings.

C. On branch circuits, use standard colors.

D. Run ground wire with power circuits; conduit shall not be grounding path.

E. Provide separate conduit systems for following.

1. As required by NEC.

F. Where power cables and instrument/signal cables enter and pass through same handhole or distribution box, steel barrier or steel conduit separation shall be maintained to avoid magnetic interaction between power cables and instrumentation conductors. In handholes, provide Type C conduit outlet body with 3/16 in. holes drilled in bottom for drainage.

G. Run instrumentation cable into control cabinets only if terminated therein.

H. Terminate control, instrumentation, and communication cables on terminal strips in separate terminal cabinets located near conduit entrances of buildings or as shown on Drawings.

I. Color Coding: Conductors for lighting and power wiring as indicated on the following page.

Phase	480/277 v
A	Brown
B	Orange
C	Yellow
Travelers	Purple
Neutral	White with non-green stripe
Ground	Green

J. Color coding for intrinsically safe systems shall be light blue.

3.04 JOINTS, TAPS, AND SPLICES

A. Where preinsulated spring connectors are used for motor and equipment connections, tape connector to wire to prevent loosening under vibration.

B. Each tap, joint or splice in conductors No. 8 AWG and larger shall be taped with 2 half-lap layers of vinyl plastic electrical tape and finish wrap of color coding tape where required by code.

C. Cable splices shall be made only in handholes, wireways, distribution boxes, and junction boxes.

3.05 WIRING DEVICES

A. Do not install devices until wiring is complete.

B. Do not use terminals on wiring devices (hot or neutral) for feed-through connections, looped or otherwise. Make circuit connections by using wire connectors and pigtails.

C. Ground receptacles with insulated green ground wire from device ground screw to bolted outlet box connection or as shown on Drawings.

D. Install GFCI receptacles as required by NEC.

3.06 MOTOR STARTERS

A. Examine area to receive motor starters to ensure adequate clearance for starter installation.

B. Install on equipment rack or structural surface.

C. Support and fasten in accordance with Section 16070.

3.07 MOTOR AND CIRCUIT DISCONNECTS

A. Locate disconnect switches as shown on Drawings and required by NEC.

B. Provide control circuit interlock as required by NEC.

C. Overcurrent protective devices.

1. Install fuses just prior to energizing equipment.

2. Locate circuit breakers as shown on Drawings.

D. Install on equipment rack or anchor firmly to wall or structural surface.

E. Support and fasten in accordance with Section 16070.

3.08 MINI-POWER CENTERS

A. Install on prefabricated brackets designed for the purpose.

B. Tighten bus connections and mechanical fasteners.

C. Adjust voltage taps for required system voltage and check grounding requirements.

3.09 FIELD QUALITY CONTROL

A. Control Circuits, Branch Circuits, Feeders, Motor Circuits, and Transformers:

1. Megger check of phase-to-phase and phase-to-ground insulation levels.

a. Do not megger check solid state equipment.

2. Continuity.

3. Short circuit.

4. Operational check.

B. Wiring Devices:

1. Test receptacles with Hubbell 5200, Woodhead 1750 or equal tester for correct polarity, proper ground connection, and wiring faults.

3.10 ADJUSTMENT AND CLEANING

A. Motor Starters and Disconnects:

1. Adjust covers and operating mechanisms for free mechanical movement.

2. Tighten wire and cable connections.

3. Verify overcurrent protection thermal unit size with motor nameplate to provide proper operation and compliance with NEC.

4. Clean interior of enclosures.

5. Touch up scratched or marred surfaces to match original finish.

B. Circuit Breakers:

1. Adjustable settings shall be set to provide selective coordination, proper operation, and compliance with NEC.

END OF SECTION

SECTION 16060

GROUNDING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems.

2. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

1.02 SUBMITTALS

A. Certificates for field testing agency, signed by CONTRACTOR, certifying that agency complies with requirements specified in "Quality Assurance" Article below.

B. Report of Field Tests and Observations: Certified by CONTRACTOR.

C. Test Results:

1. Certified field tests and observation reports indicating and interpreting test reports for compliance with performance requirements.

D. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

A. Comply with UL 467.

B. Items provided under this section shall be listed or labeled by UL or other Nationally Recognized Testing Laboratory (NRTL).

1. Term "NRTL" shall be as defined in OSHA Regulation 1910.7.

2. Terms "listed" and "labeled" shall be as defined in National Electrical Code, Article 100.

C. Regulatory Requirements:

1. National Electrical Code (NEC): Components and installation shall comply with National Fire Protection Association (NFPA) 70.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of NEC requirements, more stringent requirements and greater size, rating, and quantity indications govern.

2.02 WIRE AND CABLE GROUNDING CONDUCTORS

A. Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper.

B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Grounding-Electrode Conductors: Stranded cable.

D. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.

E. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.

2. Assembly of Stranded Conductors: ASTM B8.

3. Tinned Conductors: ASTM B33.

2.03 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 in. (1 mm) thick and 2 in. (50 mm) wide, except as indicated.

2.04 CONNECTOR PRODUCTS

A. Pressure Connectors: High-conductivity-plated units.

B. Bolted Clamps: Heavy-duty type.

C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.05 2.05 GROUNDING ELECTRODES AND TEST WELLS

A. Grounding Rods: Copper-clad steel.

1. Size: 3/4 in. by 120 in. (19 by 3000 mm).

B. Test Wells: Fabricate from 15 in. (400 mm) long, square-cut sections of 8 in. (200 mm) diameter, Schedule 80, PVC pipe or as detailed on Drawings.

PART 3 EXECUTION

3.01 APPLICATION

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

1. Install equipment grounding conductor with circuit conductors for items below in addition to those required by Code:

a. Feeders and branch circuits.

b. Lighting circuits.

c. Receptacle circuits.

d. Single-phase motor or appliance branch circuits.

e. Three-phase motor or appliance branch circuits.

f. Flexible raceway runs.

2. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply raceway with nonmetallic raceway fitting listed for purpose. Install fitting where raceway enters enclosure, and install separate equipment grounding conductor. Isolate equipment grounding conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding-conductor terminal of applicable derived system or service, except as otherwise indicated.

3. Nonmetallic Raceways: Install equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

B. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.

C. Metal Poles Supporting Outdoor Lighting Fixtures: Ground pole to grounding electrode in addition to separate equipment grounding conductor run with supply branch circuit.

D. Piping Systems and Other Equipment: Comply with NEC Article 250 for bonding requirements.

3.02 INSTALLATION

A. Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

B. Grounding Rods: Locate minimum of 1 rod length from each other and at least same distance from any other grounding electrode.

1. Drive until tops are 2 in. (50 mm) below finished floor or final grade, except as otherwise indicated.

2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.

C. Grounding Conductors: Route along shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

D. Underground Grounding Conductors: Use bare copper wire. Bury at least 24 in. (600 mm) below grade.

E. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

F. Test Wells: One for each driven grounding electrode system, except as otherwise indicated. Set top of well flush with finished grade or floor. Fill with 1 in. 25 mm) maximum-size crushed stone or gravel.

G. Concrete-Encased Duct Grounding: Fabricate according to NEC Paragraph 250-81(c), using minimum of 20 ft (6 m) of bare copper conductor not smaller than No. 4 AWG. Bond grounding conductor to reinforcing steel to at least 2 locations. Extend grounding

conductor below grade and connect to concrete pad reinforcing and to grounding electrode to concrete.

3.03 CONNECTIONS

A. Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure 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.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make visible indication that connector has been adequately compressed on grounding conductor.

H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Handholes:

1. Install driven grounding rod at an angle close to wall and set rod depth so 4 in. (100 mm) will extend above finished floor and not pierce the landfill liner below.
2. Where necessary, install grounding rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from grounding rod into manhole through waterproof sleeve in manhole wall.
3. Protect grounding rods passing through concrete floor with double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 in. (50 mm) above to 6 in. (150 mm) below concrete.
4. Where floor is specified, seal floor opening with waterproof, nonshrink grout.

B. Connections to Components:

1. Connect exposed metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to grounding rod or grounding conductor.
2. Make connections with minimum No. 4 AWG stranded, hard-drawn copper wire.
3. Train conductors plumb or level around corners and fasten to manhole walls.
4. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

C. Grounding System:

1. Ground pad-mounted equipment and noncurrent-carrying metal items by connecting them to underground cable and grounding electrodes.

3.05 FIELD QUALITY CONTROL

A. Testing:

1. Subject completed grounding system to megger test at each location where maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
2. Measure ground resistance not less than 2 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.
3. Perform tests by 2 point method according to Section 9.03 of IEEE 81.

B. Maximum grounding to resistance values are as follows:

1. Equipment Rated 500 kVA and Less: 10 ohms.
2. Handhole Grounds: 10 ohms.

C. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify ENGINEER promptly and include recommendations to reduce ground resistance and to accomplish recommended work.

D. Report: Prepare certified test reports, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

3.06 RESTORATION

A. Restore surface features, including vegetation, at areas disturbed by work of this Section.

1. Re-establish original grades, except as otherwise indicated.
2. Where sod has been removed, replace it as soon as possible after backfilling is completed.
3. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition.
4. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
5. Maintain restored surfaces.
6. Restore disturbed paving.

END OF SECTION

SECTION 16072

ELECTRICAL SUPPORTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:

B. Hangers and supports for electrical equipment and systems.

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IBC: International Building Code.

C. IMC: Intermediate metal conduit.

D. NBC: National Building Code.

E. RMC: Rigid metal conduit.

F. SBC: Standard Building Code.

G. UBC: Uniform Building Code.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified or an approved equal.

2.02 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed under this Project, with a minimum structural safety factor of five times the applied force.

B. Steel Slotted Support Systems: Comply with MFMA-3, factory-fabricated components for field assembly.

C. Manufacturers:

1. Cooper B-Line; a division of Cooper Industries.
2. ERICO International Corporation.
3. Allied Support Systems; Power-Strut Unit.
4. GS Metals Corp.
5. Michigan Hanger Co., Inc.; O-Strut Div.

6. National Pipe Hanger Corp.
7. Thomas & Betts Corporation.
8. Unistrut; Tyco International, Ltd.
9. Wesanco, Inc.
10. Or Approved Equal

D. Finishes:

1. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-3.
2. Channel Dimensions: Selected for structural loading and applicable seismic forces.

E. Raceway and Cable Supports: As described in NECA 1.

F. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

G. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

H. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M, steel plates, shapes, and bars; black and galvanized.

I. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM A325.
3. Toggle Bolts: All-steel springhead type.
4. Hanger Rods: Threaded steel.

PART 3 EXECUTION

3.01 APPLICATION

A. Comply with NECA 1 for application of hangers and supports for electrical equipment and systems, except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps.

D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-½ inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

END OF SECTION

SECTION 16075

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:

1. Identification of electrical materials, equipment, and installations.

1.02 SUBMITTALS

A. Product Data:

1. Submit for each type of product specified.

B. Miscellaneous:

1. Schedule of identification nomenclature to be used for identification signs and labels.

C. Submit in accordance with Section 01300.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:

1. National Electrical Code: Components and installation shall comply with NFPA 70.

PART 2 PRODUCTS

2.01 RACEWAY AND CABLE LABELS

A. Manufacturer's Standard Products: Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.

B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.

1. Color: Black legend on orange field.

2. Legend: Indicates voltage.

C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is overlaminated with clear, wear and chemical resistant coating.

D. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color coded, acrylic bands sized to suit diameter of line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.

E. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 in. wide (0.08 mm thick by 25 to 51 mm wide).

F. Underground Line Warning Tape: Permanent, bright colored, continuous printed, vinyl tape with following features:

1. Size: Not less than 6 in. wide by 4 mils thick (152 mm wide by 0.102 mm thick).
2. Compounded for permanent direct burial service.
3. Embedded continuous metallic strip or core.
4. Printed Legend: Indicates type of underground line.

G. Tape Markers: Vinyl or vinyl cloth, self-adhesive, wraparound type with preprinted numbers and letters.

2.02 ENGRAVED NAMEPLATES AND SIGNS

A. Manufacturer's Standard Products: Where more than one type is listed for specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, or as specified elsewhere.

B. Engraving stock, melamine plastic laminate, 1/16 in. (1.6 mm) minimum thick for signs up to 20 sq in. (129 sq cm), 1/8 in. (3.2 mm) thick for larger sizes.

1. Engraved Legend: Black letters on white face.
2. Punched for mechanical fasteners.

C. Baked Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for application. 1/4 in. (6.4 mm) grommets in corners for mounting.

D. Exterior, Metal Backed, Butyrate Signs: Wear resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396 in. (1 mm), galvanized steel backing, with colors, legend, and size appropriate to application. 1/4 in. (6.4 mm) grommets in corners for mounting.

E. Fasteners for Plastic Laminated and Metal Signs: Self tapping stainless steel screws or No. 10/32 stainless steel machine screws with nuts, flat washers and lock washers.

2.03 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1 piece, self-locking, Type 6/6 nylon cable ties with following features:

1. Minimum Width: 3/16 in. (5 mm).
2. Tensile Strength: 50 lb (22.3 kg) minimum.
3. Temperature Range: Minus 40 to 185°F (-4 to 85°C).
4. Color: As indicated where used for color coding.

B. Paint: Alkyd-urethane enamel. Primer as recommended by enamel manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install identification devices according to manufacturer's written instructions.

B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and or designations used for electrical identification with corresponding designations used in Contract Documents or required by codes and standards. Use consistent designations throughout Project.

D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.

F. Identify feeders over 600 V with "DANGER-HIGH VOLTAGE" in black letters 2 in. (51 mm) high, stenciled with paint at 10 ft (3 m) intervals over continuous, painted orange background. Identify following:

1. Entire floor area directly above conduits running beneath and within 12 in. (305 mm) of basement or ground floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to conduits concealed within wall.
3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.
4. Entire surface of exposed conduits.

G. Install painted identification as follows:

1. Clean surfaces of dust, loose material, and oily films before painting.
2. Prime Surfaces: For galvanized metal, use single component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy duty, acrylic resin block filler. For concrete surfaces, use clear, alkali resistant, alkyd binder type sealer.
3. Apply 1 intermediate and 1 finish coat of silicone alkyd enamel.
4. Apply primer and finish materials according to manufacturer's instructions.

H. Install Caution Signs for Enclosures Over 600 V: Use pressure sensitive, self-adhesive label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover.

I. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 in. (150 to 200 mm) below finished grade. Where multiple lines installed in common trench or concrete envelope do not exceed an overall width of 16 in. (400 mm), use single line marker.

1. Install line marker for underground wiring, both direct buried and in raceway.

J. Color Code Conductors: Secondary service, feeder, and branch circuit conductors throughout secondary electrical system.

1. Field applied, color coding methods may be used in lieu of factory coded wire for sizes larger than No. 10 AWG.
    a. Colored, pressure sensitive plastic tape in half lapped turns for distance of 6 in. (150 mm) from terminal points and in boxes where splices or taps are made. Apply last 2 turns of tape with no tension to prevent

possible unwinding. Use 1 in. (25 mm) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.

b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 in. (76 mm) from terminal and spaced 3 in. (76 mm) apart. Apply with special tool or pliers, tighten to snug fit, and cut off excess length.

K. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.

1. Legend: 1/4 in. (6.4 mm) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.

2. Fasten tags with nylon cable ties; fasten bands using integral ears.

L. Apply identification to conductors as follows:

1. Conductors to Be Extended in Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.

3. Multiple Control and Communications Circuits in Same Enclosure: Identify each conductor by its system and circuit designation. Use consistent system of tags, color coding, or cable marking tape.

M. Apply warning, caution, and instruction signs and stencils as follows:

1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

2. Emergency Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8 in. (9 mm) high lettering for emergency instructions on power transfer, load shedding, and or emergency operations.

N. Install identification as follows:

1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide single line of text with 1/2 in. (13 mm) high lettering on 1-1/2 in. (38 mm) high label; where 2 lines of text are required, use lettering 2 in. (51 mm) high. Use black lettering on white field. Apply labels for each unit of following categories of equipment.

a. Electrical cabinets and enclosures.

b. Motor starters.

c. Push button stations.

d. Control devices.

e. Mini-power centers.

2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

END OF SECTION

SECTION 16120

WIRE AND CABLE

PART 1 GENERAL

1.01 WORK INCLUDED

A. Building wire.

B. Wiring connections and terminations.

1.02 REFERENCES

A. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

PART 2 PRODUCTS

2.01 BUILDING WIRE

A. Thermoplastic-insulated Building Wire: NEMA WC 5.

B. Feeders and Branch Circuits Larger than 6 AWG: Copper, stranded conductor, 600-volt insulation, THWN.

C. Feeders and Branch Circuits 6 AWG and Smaller: Copper conductor, 600-volt insulation THWN, 6 and 8 AWG, stranded conductor; smaller than 8 AWG, stranded conductor.

D. Control Circuits: Copper, stranded conductor 600-volt insulation, THWN.

PART 3 EXECUTION

3.01 GENERAL WIRING METHODS

A. Conductors shall be furnished and installed as detailed on the plans and as specified herein.

B. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

C. Place an equal number of conductors for each phase of a circuit in same raceway or cable.

D. Provide grounding conductor in all branch circuit and feeder conduits.

E. Splice only in junction or outlet boxes.

F. Neatly train and lace wiring inside boxes, equipment, and panelboards.

G. Make Conductor lengths for parallel circuits equal.

3.02 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricate for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Completely and thoroughly swab raceway system before installing conductors.

3.03 WIRING CONNECTIONS AND TERMINATIONS

A. Splice only in accessible junction boxes.

B. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

C. Use split bolt connectors for copper wire splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

D. Thoroughly clean wires before installing lugs and connectors.

E. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

F. Terminate spare conductors with electrical tape.

3.04 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 16010.

B. Inspect wire and cable for physical damage and proper connection.

C. Torque test conductor connections and terminations to manufacturer's recommended values.

D. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

3.05 WIRE AND CABLE INSTALLATION SCHEDULE

A. Concealed Interior Locations: Building wire in raceways.

B. Exposed Interior Locations: Building wire in raceways.

C. Wet or Damp Interior Locations: Building wire in raceway.

D. Exterior Locations: Building wire in raceways.

E. Underground Locations: Building wire in raceways.

END OF SECTION

SECTION 16130

BOXES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Wall and ceiling outlet boxes.

B. Pull and junction boxes.

1.02 RELATED WORK

A. Section 16160 - Cabinets and Enclosures.

1.03 REFERENCES

A. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

PART 2 PRODUCTS

2.01 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, with 1/2 inch (13 mm) male fixture studs where required.

B. Cast Boxes: Cast feralloy, deep type, gasketed cover threaded hubs.

2.02 PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet Metal Boxes Larger than 12 Inches (300 mm) in Any Dimension: Hinged enclosure in accordance with Section 16160.

C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 3R, flat-flanged, surface-mounted junction box, UL listed as rain tight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, outside flanged, recessed cover box for flush mounting, UL listed as rain tight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.

PART 3 EXECUTION

3.01 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on Drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on Contract Drawings are approximate unless dimensioned.

C. Locate and install boxes to allow access.

D. Locate and install to maintain headroom and to present a neat appearance.

3.02 OUTLET BOX INSTALLATION

A. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

B. Provide knockout closures for unused openings.

C. Support boxes independently of conduit except for cast boxes that is connected to two rigid metal conduits, both supported within 12 inches (300 mm) of box.

D. Use multiple-gang boxes where more than one device are mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

E. Install boxes in walls without damaging wall insulation.

F. Provide cast outlet boxes in exterior locations exposed to the weather and wet locations.

3.03 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes in unfinished areas.

B. Support pull and junction boxes independent of conduit.

END OF SECTION

SECTION 16160

CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 WORK INCLUDED

A. Hinged cover enclosures.

B. Terminal blocks and accessories.

1.02 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

B. ANSI/NEMA ICS 1 - Industrial Control and Systems.

C. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems.

D. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems.

1.03 SUBMITTALS

A. Submit product data under provisions of Section 16010.

B. Shop Drawings for Equipment Panels: Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.

PART 2 PRODUCTS

2.01 HINGED COVER ENCLOSURES

A. Construction: NEMA 250; Type 3R, stainless steel for all locations except Plymouth. Plymouth Location shall be Type 12 painted steel. Insulated panels.

B. Finish: Two (2) coats of gray enamel over a prime coat.

C. Covers: Continuous hinge with stainless steel hinge pins held closed by flush latch operable by key.

D. Hinged Inner Dead Front Door: All operating devices shall mount on or through the inner door. All components mounted through inner door shall be clearly identified by lamicoid nameplates.

E. Panel for Mounting Terminal Blocks or Electrical Components: 14 gage steel, white enamel finish.

2.02 TERMINAL BLOCKS AND ACCESSORIES

A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.

B. Power Terminals: Unit construction type, closed-back type, with tubular pressure screw connectors, rated 600 volts.

C. Signal and Control Terminals: Modular construction type, channel mounted; tubular pressure screw connectors, rated 600 volts.

2.03 FABRICATION

A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

B. Pump Control Enclosures shall be sized appropriately for the pump controls, motor starters, etc. Enclosures shall be mounted on 6-inch-high legs that are secured by anchor bolts to floor which is a 6-inch-thick, reinforced concrete slab.

C. Provide knockouts on enclosures.

D. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.

B. Provide accessory feet and 6" high legs that are secured by anchor bolts for free-standing equipment enclosures.

C. Install trim plumb.

END OF SECTION

SECTION 16900

INSTRUMENTATION & CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Programming modifications to integrate the new sludge press control panel into the existing plant control system. This includes adding alarms, monitoring displays and trends, etc. necessary to monitor the sludge press from the control room.

B. Field installation and wiring of all instrumentation, control panels, network, control, and instrumentation wiring, etc. shall be performed by the project electrical contractor as shown on the project drawings.

1.02 SUBMITTALS

A. None required.

1.03 SPECIAL PROVISIONS

A. The project systems integrator shall be responsible for the work described in this section.

1.04 SPECIAL WARRANTY

A. All labor required for normal operation of systems shall be free of charge for a period of one (1) year after installation.

1.05 DELIVERY, STORAGE AND HANDLING:

A. N/A

1.06 MAINTENANCE:

A. N/A

1.07 CONTROL SYSTEM DESCRIPTION

Overview:

A. The CONTROL system shall consist of the following locations:

1. MIP – Main Instrument Panel

a. Existing Panel, modifications to PLC/HMI as required

B. MIP – Main Instrument Panel

1. This panel houses the wastewater system PLC and HMI. These components shall be modified to support remote monitoring and control of the new Sludge Press control system as described below. Control and HMI functionality shall be

executed in a professional manner and with accordance with industry standards. Final acceptance of the control and HMI development shall be subject to the approval of the ENGINEER.

a. Functional Description:

1) Provide control and monitoring in coordination with the OEM.

2) The operator shall have full monitoring capabilities of the Sludge Press control system from this location.

3) HMI screens and functionality shall be consistent with the existing Wastewater System screens and functions.

1.08 MEASUREMENT AND PAYMENT

A. Measurement and payment shall be accordance with Section 01200.

PART 2 PRODUCTS

2.01 PANELS GENERAL

A. N/A

2.02 APPROVED MANUFACTURERS

A. Approved SCADA SYSTEM INTEGRATORS

1. Talsma Controls Company

2. Engineer Approved Equal.

B. Any SCADA Systems Integrator, other than specified, proposing to provide and develop a SCADA system fully compatible with the existing County SCADA system shall submit a pre-bid qualifications package and shall:

1. Submit sufficient information to the ENGINEER to determine uniformity in System Integrator's SCADA system equipment operational platform with the existing system, uniformity in programming ladder logic with the existing SCADA system, uniformity in HMI display appearance with the existing SCADA system and uniformity in Operator HMI operation procedures with the existing SCADA system.

2. Have a full-time qualified Service Technician available 24 hours per day for emergency call-outs directly employed by the Systems Integrator located within 50 road miles of the project site.

3. Demonstrate experience providing and servicing municipal water and wastewater treatment SCADA systems of scale equal to or greater than the project for a minimum of 10 years.

4. Provide a list of references including contact information for no less than five (5) municipal clients owning and operating the candidate's SCADA system within 100 miles of the project location. A minimum of three of the SCADA systems

referenced shall have been in operation more than five years; two of the referenced SCADA systems have been in operation less than five years.

This information must be received by the ENGINEER not less than 5 days prior to the bid date. The ENGINEER will issue an addendum prior to the bid date which lists any additional pre-approved SCADA System Integrators. Contractors and SCADA System Integrators are advised that a SCADA System Integrator named as an approved supplier is not excused from meeting all of the technical and performance requirements of this specification.

C. In the event the SCADA System Integrator elects to bid that does not comply with the above experience requirements, then the Contractor shall submit with their bid, a three-year maintenance bond executed by an Officer of the SCADA System Integrator firm in the amount of 150% of the SCADA, control and instrumentation price guaranteeing repair or replacement of the Instrumentation and Control system in the event of a failure for a period of three years after the specified warranty. During such three year period the Systems Integrator shall repair, modify or replace the system in a manner acceptable to the Owner, if the operation of the system is unsatisfactory. Normal wear or malfunctions due to neglect or abuse will not be considered justifiable reasons for unsatisfactory operation. In the event the Owner determines the operation of the control and instrumentation system to be unsatisfactory during this three-year period and the manufacturer fails to correct the deficiencies within two (2) weeks from the time the Systems Integrator is first notified in writing that such deficiencies exist, the Owner will, as its sole option, make the necessary repairs or replacement and deduct costs from the aforementioned bond of the Systems Integrator.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Control system modifications shall be completed prior to sludge press startup so as to have alarming capabilities when operation commences.

3.02 DOCUMENTATION

A. All configuration programs shall become the property of the owner at time of final completion. No password protection of any kind shall be enabled unless instructed to do so by the ENGINEER. Provide three copies of project documentation on portable hard drive and a hard copy. Project documentation shall include:

1. PLC programs – hard copy and electronic copy (*.rss files).

2. HMI programs – hard copy and electronic copy (*.mer, *.apa).

3.03 START-UP

A. Arrange and pay for the services of the System Integrator’s competent service technician to inspect the installation before being put into service and to be present during start-up and initial operation of equipment for a period of one (1) 8-hour day. Start-up shall consist of verification of communications, tag mapping, etc. Scheduling and

coordination for will be by written request submittal to the ENGINEER for approval. Provide System Integrator's start-up report to ENGINEER prior to Substantial Completion.

3.04 OPERATOR TRAINING:

A. Arrange and pay for the services of the System Integrator's competent service technician to instruct the OWNER's operators in the proper maintenance and operation of all equipment provided under this specification section. The instruction period shall be a minimum of one 8-hour session, not including travel time.

END OF SECTION

APPENDIX A

Or-Tec Equipment Submittal

DATE
2021

OR-TEC
Job No: 2729

MARQUETTE COUNTY
K.I. SAWYER WATER

We are sending you ____Enclosed __X__**Attached** _____Under separate cover via_____
The following items:

_____Shop drawings _____Prints _____Plans __X___**Submittals**

_____Specifications _____Copy of letter ____Change order _____Other

Copies _____ Description: _____

THESE ARE TRANSMITTED as checked below:

___X____**For approval** _____Approved as submitted _____Resubmit _____copies for approval

_____For you use _____Approved as noted _____Submit _____copies for distribution

____ As requested _____Returned for correction _____Return _____corrected prints

_____For review and comment

_____FOR BIDS DUE _____

REMARKS

Preliminary submittal. Final approved submittal will be provided when available.

or-tec inc ≈ 14500 industrial ave south ≈ maple heights oh 44137 ≈ usa
or-tec.com ≈ p 216-475-5225 ≈ f 216-475-5229 ≈ info@or-tec.com

I have reviewed these submittal documents for

Marquette County

I am approving them as is and am authorized to sign.

Signature: _____

Name: _____

Title: _____

Date: _____

Please return by fax and mail an original copy of the entire submittal signed and dated. Equipment fabrication will be started upon receipt of signed proposal

SUBMITTAL DATA
MARQUETE COUNTY
OR-TEC Gemini

1.7 Meter S.S.
DOUBLE BELT PRESS

INDEX

PART 1 – GENERAL

PART 2 – BELT PRESS DEWATERING SYSTEM

PART 3 – POLYMER DOSING

PART 4 – WASH WATER PUMP

PART 5 – SLUDGE PUMP

PART 6 – AUGER

PART 7 – CONTROL PANEL

~~**PART 8 – TRAILER**~~

PART 9 – DELIVERY, WARRANTY, START-UP

PART 10 - OVERPRESSURE PROTECTION DEVICES

All information included as part of the accompanying proposal shall remain the sole property of OR-TEC, Inc. in conformance with the copyright laws and regulations of the United States. This proposal may not be photocopied or faxed without the prior approval of OR-TEC, Inc. The data herein is furnished on a restricted basis and is not to be used in any way detrimental to the interest of OR-TEC, Inc.

PART 1 - GENERAL
OPERATION CONDITIONS:

1.1 OPERATIVE CONDITIONS, Aerobically Digested Sludge

Item	Requirements
Sludge Feed Concentration	1 – 1.5%
Polymer Dosage	N/A
pH	6.8 – 7.2
Volatile Solids Content	65 – 75%
Capture	93 – 95%
Final Cake	16% minimum

1.2 EQUIPMENT SPECIFICATIONS

MODEL: GEMINI Belt Press - 1.7 Meter	
Construction	304 Stainless Steel
Length	15’-6”
Width (frame)	99 5/8”
Height	7’-5”
Weight	7300 lbs.
Belt Wash	43 gallons/min. @ 80psi
Belt Length	A = 574.75” B = 389.5”
Belt Width	89 5/8”

PART 2 - GENERAL

BELT PRESS DEWATERING SYSTEM

SYSTEM DESCRIPTION

BELT PRESS

The OR-TEC GEMINI Sludge Dewatering System shall consist of a belt filter press and all appurtenances. These specifications contain both performance and mechanical requirements. The equipment proposed and furnished shall meet all performance and all mechanical requirements. The Belt Filter Press shall be a complete prefabricated unit consisting of:

2.01 Sludge Conditioning System
2.02 Structural Main Frame
2.03 Gravity Drainage Section
2.04 Pressure Section
2.05 Rollers
2.06 Bearings
2.07 Belt Wash System
2.08 Belt Alignment System
2.09 Belt Tensioning System
2.10 Belt Drive System
2.11 Filter Belts
2.12 Discharge Blades
2.13 Drainage Pans
2.14 Press Mounted Control Devices

All materials used in the construction of the sludge dewatering equipment shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the ASTM Standard Specification for Structural Steel, Designation A36-77a. All iron casting shall conform to the ASTM Standard Specifications for Gray Iron Castings, Designation A48-76, and shall be of a class suitable for the purpose intended. Other materials shall conform to the ASTM Specifications where such specifications exist; the use of such materials shall be based on continuous and successful use under similar conditions of service.

Unless otherwise specified herein, all materials in contact with polyelectrolyte (polymer) or sludge shall be of Type 304 stainless steel. All fasteners, pins, and anchor bolts shall be Type 304 stainless steel

2.01 SLUDGE CONDITIONING SYSTEM

1. A Sludge Conditioning System, designed to efficiently mix polymer with the sludge and to adequately condition the sludge, for optimum dewatering shall be provided.

2. The sludge conditioning system shall be mounted upstream of the press and shall be a two stage system consisting of polymer injection and flocculation; all as follows:

   A. Diluted polymer shall be injected into the sludge stream in a manner that maximizes dispersion.

   B. The flocculation stage has the purpose of optimizing the polymer to sludge solids bonding reaction with minimal shear. To achieve optimal conditions, the sludge velocity shall be reduced to less than 15 ft/minute for a period of no less than 1 second for each gpm throughput. An adequately sized flocculation tank/stilling well constructed of 304 SS shall be provided complete with bottom dump valve.

2.02 STRUCTURAL MAIN FRAME:

1. The structural main frame shall be fabricated of stainless steel members conforming to ASTM Standard Specifications for Standard Steel, Designation A36-77a, and A500 into a rigid structure, adequately braced to withstand intended loads without excessive vibration or deflection.

2. A minimum level of frame rigidity requires that all load bearing members be constructed of tubing, wide flange beam, or channel such that the minimum moment of inertia shall exceed 32 inches to the fourth power. In addition, the dual belt compression/shear beam, as well as all other frame members, shall have a minimum safety factor under maximum load of 5 times the design yield strength of the member.

3. Maximum load shall be based on the summation of all forces applied to the frame including, but not limited to, roller mass forces and tension forces (forces exerted by the tension on the belts from the belt tensioning devices). Tension forces shall include, but not be limited to, a belt tension of 50 PLI which is equivalent to 200 pounds per inch of belt width in the shear pressure section. Disassembly of the frame shall not be required for roll removal.

4. The framework shall be of welded and/or bolted construction. All welding shall conform to the American Welding Society Structural Welding Code.

5. The structure shall be designed for installation on a prepared concrete foundation and secured with anchor bolts.

2.03 GRAVITY DRAINAGE SECTION

1. The gravity drainage section shall be provided to accept sludge from the Sludge Conditioning System. The gravity drainage section shall contain an inlet distributor to evenly distribute the conditioned sludge over the effective width of the moving filter belt. The minimum effective dewatering area of the gravity zone for the upper belt will be 71.33ft², and the minimum effective dewatering area of the gravity zone for the lower belt will be 41.96ft²

2. The materials in contact with the sludge in the distribution area shall be Type 304 stainless steel, with a minimum thickness of 14 ga.

3. The conditioned sludge shall be contained on the belt with Type 304 stainless steel barriers, 14 gauge minimum thickness, and equipped with replaceable seals to prevent leakage.

4. The filter belt, while in the gravity drainage section, shall be supported by a Type 304 stainless steel grid, fitted with high density polyethylene wear bars. The belt support grid shall be a minimum of 2 inches wider than the belt and so designed to reduce belt wear.

5. The gravity drainage section shall be furnished with plows to adequately furrow the conditioned sludge to facilitate drainage. The plows shall be constructed of high density polyethylene with 304 stainless steel holders and provided with a lifting handle, designed to remove the entire row of plows at least 6 inches from the belt, out of the sludge flow, to facilitate cleaning. There shall be a minimum of six (6) rows of plows and individual plows shall be spaced at a minimum of 10" laterally across the filter belt.

2.04 PRESSURE SECTION

1. A pressure section, following the gravity drainage section shall consist of two (2) stages, the increasing pressure zone (wedge) which will have an approx. effective dewatering area of 26.29 ft² and the shear pressure zone which will have an approx. effective dewatering area of 48.96ft².

2. The first stage of the pressure section shall be the increasing pressure zone, where the upper and lower belts gradually converge, creating a belt/sludge sandwich, and there the sludge cake is prepared for the shear pressure zone by generating continuously increasing pressure on the sludge as it travels through the zone. The lower belt in the increasing pressure zone shall be supported in the same manner as the belt is supported in the gravity drainage section.

3. The second stage of the pressure section shall be the shear pressure zone consisting of one (1) 18" stainless steel perforated roller and a minimum of seven (7) rollers, arranged to provide an "S" shaped pattern of belt travel. The sludge, which is sandwiched between the belts, shall be subjected to an incremental increase in pressure, without an increase in

belt tension, as the belt/sludge sandwich travels over decreasing diameter rollers toward the cake discharge. The first roller in the Pressure Zone shall be a 304 stainless steel perforated roll. The minimum wrap on this roll shall be 231 degrees. Six (6) pressure rollers shall have a minimum of 180 degrees wrap on each roll.

4. Rollers shall be cylindrical in shape and constructed as specified under "Rollers". The rollers shall be supported by bearings mounted on the end shafts as specified under "Bearings".

5. The pressure zone configuration shall be such that the filtrate is removed from the sludge cake without rewetting of the downstream cake.

2.05 ROLLERS

1. All rollers shall be constructed of 304 stainless steel and carbon steel. Carbon steel roller surfaces shall not be exposed to sludge or moisture. Roller wall tubing is carbon steel with a minimum of 3/16” wall thickness coated with a Buna-N rubber coating (Shore A hardness 70). The roller journal to roller head is interference fitted and welded. The head to roller tubing is interference press fitted.

2. All perforated rollers shall be of Type 304 stainless steel construction, with a minimum thickness of 1/8 inch.

3. Drive rollers wall tubing is carbon steel with a minimum of 3/16” wall thickness coated with a Buna-N rubber coating (Shore A hardness 70) to permit slip-free transmission of driving torque to the belt. The ends of the shafts of each drive roller shall be equipped with a support bearing as specified under "Bearings".

4. The complete rollers assembly, as specified herein, shall be warranted for a period of three (3) years from date of start-up, not to exceed three and a half years from the date of delivery. Neither the rollers nor Buna-N coating shall require preventive maintenance during the warranty period. The warranty shall include all parts and labor for repairing or replacing any item that fails during the warranty period, provided the damage is not due to misuse or neglect by others.

2.06 BEARINGS

1. All rollers are supported by greaseable type, high capacity "E" design roller bearings, in sealed, splashproof, horizontal split case pillow block housing. The bearings are direct

mounted to the shaft. Bearings are mounted so that the loads are transmitted through the base of the bearing, not the cap.

2. All bearings shall have an L10 bearing life of 750,000 hours, at a belt speed of 5.0 m/m calculated by using the ANSI/AFBMA, Std 11-1978, standard with 1.15 capacity modification factor per ISO recommendation. The L10 life is based on the summation of all forces applied to the bearings, including, but not limited to, roller mass forces and belt tension on the rollers. The belt tension forces exerted on the pressure zone rollers shall include a belt tension of 50 PLI which equates to a load of 200 pounds per lineal inch of belt width.

3. Bearing housings are Class 30 cast iron with two (2) mounting bolts and two (2) cap bolts. All hardware is Type 304 stainless steel.

4. The bearing seal in the pillow block housing is a nonmetallic lip type seal.

5. Bearing lubrication is performed through a Type 316 stainless steel grease fitting mounted on the bearing housing. All bearings are outboard (externally mounted).

2.07 BELT WASH SYSTEM

1. Each Belt Filter Press shall be equipped with individual belt wash stations for both the upper and lower belts. Each station shall consist of a spray pipe, fitted with spray nozzles, contained within a fabricated housing which encapsulates the upper section of each belt. The housing and nozzle assembly shall be readily removable.

2. Nozzle spacing and spray pattern shall be such that the sprays from adjacent nozzles overlap one another at the belt surface. The spray pipe and nozzles shall be of Type 304 stainless steel construction. Individual nozzles shall be replaceable.

3. The housing shall be fabricated from Type 304 stainless steel with a minimum thickness of 16 gauge.

4. Each belt wash station shall be furnished with an external handwheel which is mounted to a stainless steel cleaning brush located inside the spray pipe. One full turn of the handwheel shall cause the brush bristles to enter each spray nozzle, and dislodge any solid particles which have accumulated, open a valve and allow the solids particles to be flushed into the drainage system.

5. Each belt wash station shall be positioned such that the washing is performed after the cake has been discharged from the belt. The belt wash-station shall extend over the full width of the filter belt by a minimum of two (2) inches. The belt shall be cleaned by the belt wash with no blinding.

6. The belt wash system for the Belt Filter Press shall be suitable for use with water supplied at a minimum pressure of 85 psig.

2.08 BELT ALIGNMENT SYSTEM

1. Each belt shall be provided with an automatic belt alignment system to assure proper alignment of both belts at all times. The alignment system shall be electromechanically actuated. It shall be a Danaher Electrak Pro series.

2. The belt alignment system shall be provided with sensing devices designed with polyethylene finger which rides on the edge of the belts to detect their position. The arm shall operate based on preset switch set-points which in turn affects the position of an electrically actuator connected to a pivoting belt alignment roller. The pivoting action of the belt alignment roller shall cause this roller to skew from its transverse position to guide the belts centrally along their path.

3. The alignment systems shall function as a continuous automatic belt guidance system and shall be an integral part of the press. The alignment system shall operate with smooth and slow motions resulting in a minimum of belt travel from side to side.

4. Rollers for the belt aligning system shall be constructed as specified under "**Rollers**". Support bearings for these rollers shall be as specified under "**Bearings**".

5. Back-up limit switches for the belt alignment system shall be provided on the machine with sufficient contacts to de-energize all drives.

6. All conduits, sensors, motors, and controls necessary to provide a complete and operational system shall be included.

2.09 BELT TENSIONING SYSTEM

1. Each belt shall be provided with an individually adjustable belt tensioning system. The belt tensioning system shall be electromechanically actuated. The design of the tensioning system shall be such that dewatering pressure is directly proportional to belt tension and that adjustments in tension shall result in immediate changes in dewatering pressure.

2. The belt tensioning system shall be furnished with an individual control station such that independent shut-off for each belt is possible. Actual dewatering pressure, as indicated by the set-point selected on the control station, shall be maintained automatically despite process changes.

3. The belts shall be furnished with tension rollers. Rollers for the belt tensioning system shall be cylindrical in shape constructed as specified under "**Rollers**. The ends of the shaft shall be supported by bearings as specified under "**Bearings**".

4. The belt tensioning system shall accommodate a minimum of 2.5% increase in belt length.

5. The motor will be a ¼ Hp black Max Vector duty type, which will be connected to a Nook ActionJac which will put load onto a central pivot point. The load will be set by using a high accuracy miniature universal load cell.

2.10 BELT DRIVE

1. Two (2) rollers must be driven, each by a helical gear reducer powered by an A.C. motor. Both devices must be synchronized and driven by a single A.C. variable frequency controller. Drives shall be 480 volt, 60 Hz, 3-Phase.

2.11 DEWATERING BELTS

1. The GEMINI Belt Filter Press shall incorporate the use of two dewatering belts. Each belt shall have drive rollers. The method of belt change-out shall be demonstrated and shall show that each belt can be replaced by two men within two hours without disassembly of the equipment.

2. Belts shall be seamed and fabricated of monofilament polyester. The mesh design shall be selected for optimum dewatering of the sludge to be processed with minimum blinding of the filter belt.

3. Each belt and connecting splice shall be designed for a minimum tensile strength equal to five times the normal maximum dynamic tension to which the belt shall be subjected. The splice shall be designed to fail before the belt and shall be constructed of Type 316 stainless steel.

4. Belts shall have a minimum life of 2,000 hours continuous operation at the rated design conditions.

2.12 DISCHARGE BLADES

1. Discharge blades shall be provided to scrape dewatered sludge from the belt at the final discharge rollers. The blades shall be of ultra high molecular weight polyethylene

construction and shall be readily removable and designed to wear before the filter belts.

2. The blades shall be affixed to a stainless steel counterweight assembly with a type 304 stainless steel holder. The blades and assembly shall be fabricated with sufficient stiffness so that the blades do not warp, distort or bow under normal service conditions.

3. The assembly shall be equipped with devices to enable the blades to be quickly released and locked in position away from contact with the belts for cleaning and maintenance.

2.13 DRAINAGE PANS

1. Drainage pans shall be supplied as necessary to contain all filtrate and washwater within the belt filter press without splashing and to prevent rewetting of downstream cake. Filtrate and washwater pans shall be constructed of minimum 14 gauge, 304 stainless steel material suitable for the intended service.

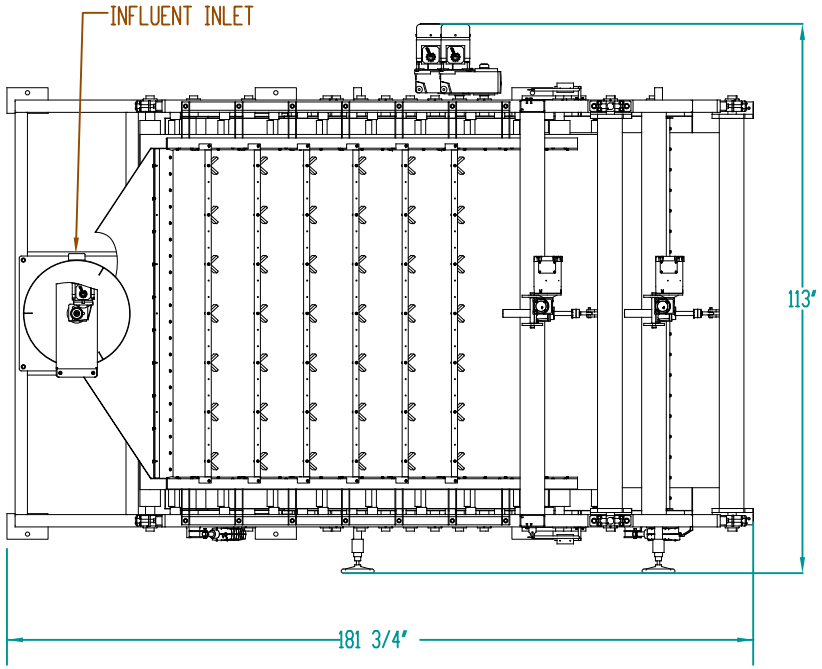
2. All drainage piping shall be furnished adequately sized for the intended service and rigidly attached to the press frame. Drain connection shall be self-venting to prevent overflow. Flushing connections or similar provisions shall be provided for easy access during cleaning. Drainage pans shall be located such that the moving belts do not come into contact with the pans under any conditions.

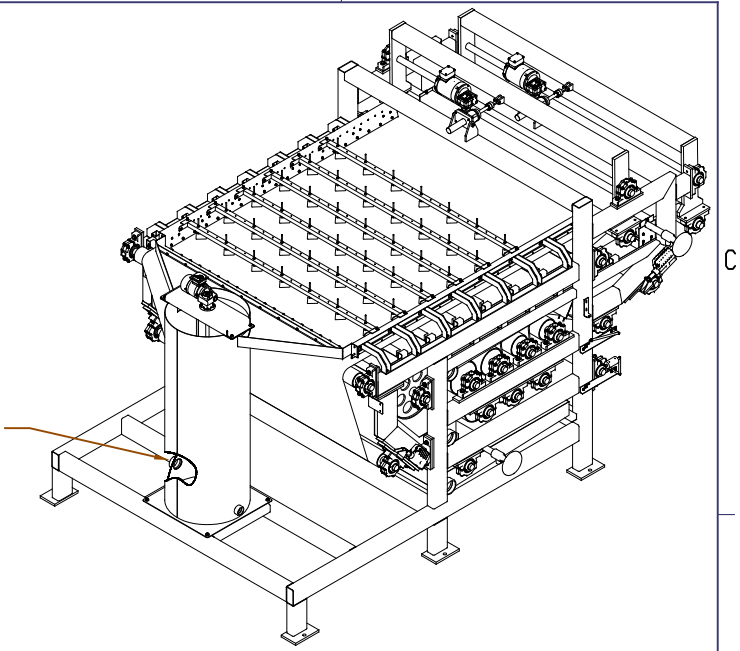
2.14 PRESS MOUNTED CONTROL DEVICES

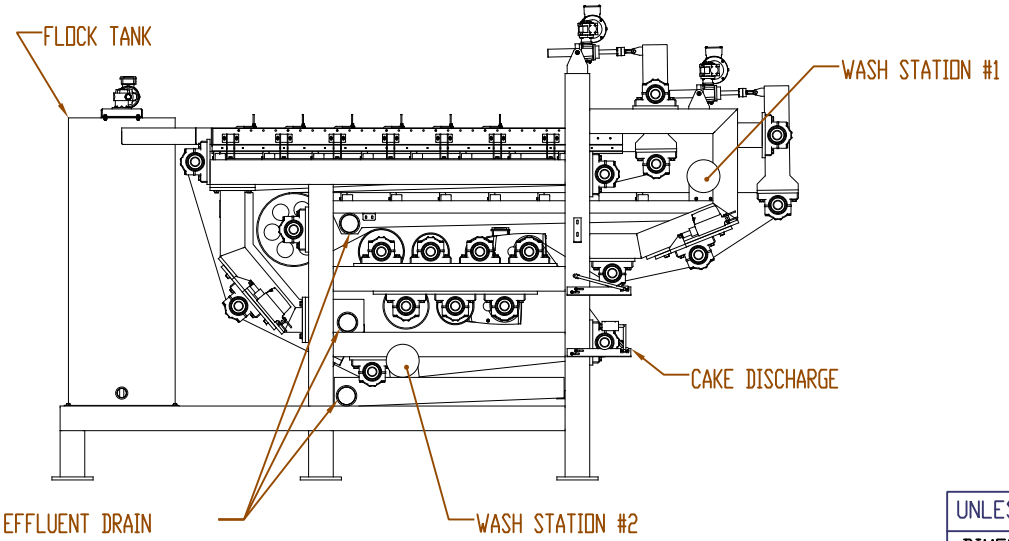
1. Control devices shall include emergency disconnect switch, belt off track limit switches and wash water pressure switch.

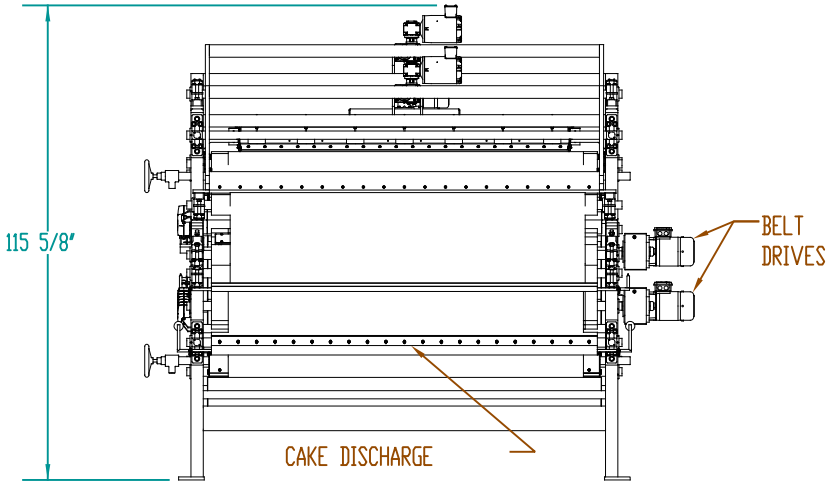
2. Electrical devices shall be shop wired per National Electrical Code Specifications and shall include flexible non-metallic conduit. Conduit shall be routed in a protective enclosure to limit exposure to process liquids.

3. A safety trip cord shall be provided along the side of the belt filter press, and shall immediately interrupt all power to the system when activated. The trip wire is to provide emergency shutdown of the belt filter presses should anything be in danger of being caught in the rotating equipment.









NOTE:
CONTROL PANEL, SLUDGE PUMP, WASHWATER PUMP NO SHOWN

NOT TO SCALE

PROPRIETARY AND CONFIDENTIAL

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REV.	DESCRIPTION	APRVD.	DATE
A	IR	AG	2/27/2017

REVISIONS

UNLESS OTHERWISE SPECIFIED:

DIMENSIONS ARE IN INCHES

TOLERANCES:
FRACTIONAL ±1/16
ANGULAR ±0.5°
ONE PLACE DECIMAL ±.1
TWO PLACE DECIMAL ±.03
THREE PLACE DECIMAL ±.010

	NAME	DATE
DRAWN BY	AG	7/6/2016
CHECKED		

TITLE: GEMINI 1.7 METER

GENERAL LAYOUT

SIZE A

OR-TEC INCORPORATED
14500 SOUTH INDUSTRIAL RD
MAPLE HEIGHTS, OHIO USA
216-475-5225

DWG. NO. GEMINI_1700_LAYOUT

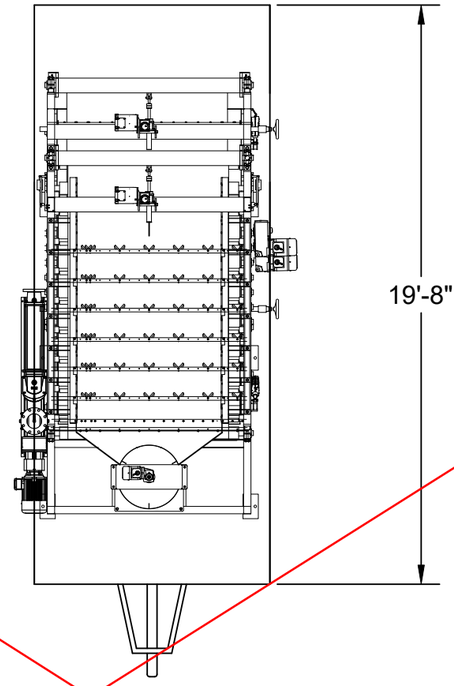
REV: A

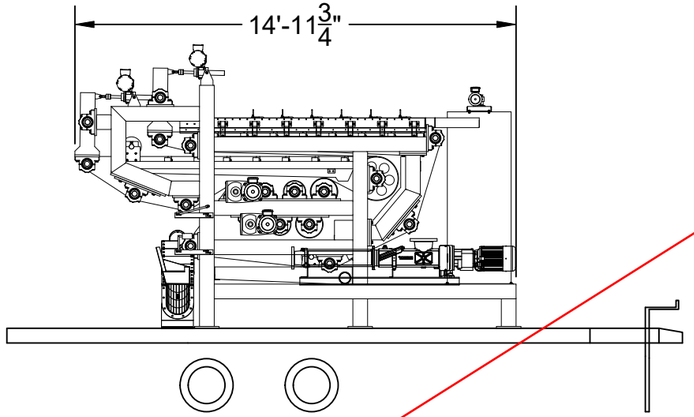
PRODUCT LINE: GM17

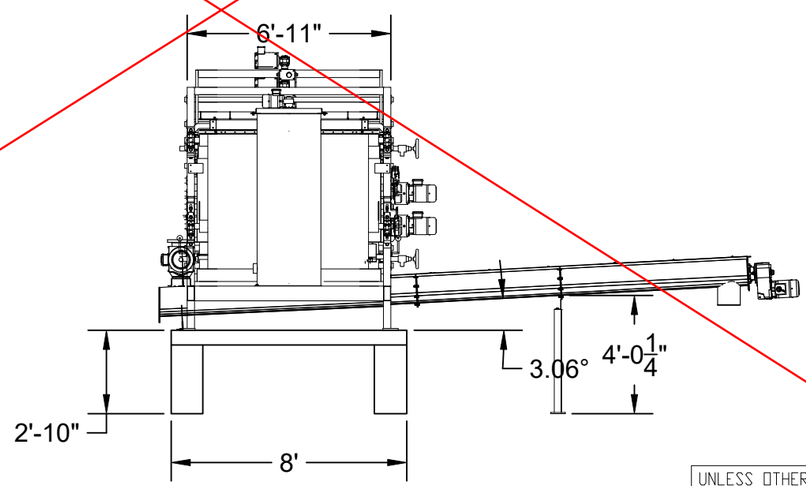
SCALE: 1:48

SHEET 1 OF 1

NOT TRAILER MOUNTED







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TOLERANCES:
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ANGULAR ±0.5°
ONE PLACE DECIMAL ±.1
TWO PLACE DECIMAL ±.03
THREE PLACE DECIMAL ±.010

	NAME	DATE
DRAWN BY	KP	10/5/21
CHECKED		

TITLE: GEMINI BELT PRESS 1700 SERIES

GENERAL LAYOUT

SIZE B

OR-TEC INCORPORATED
14500 SOUTH INDUSTRIAL RD
MAPLE HEIGHTS, OHIO USA
216-475-5225

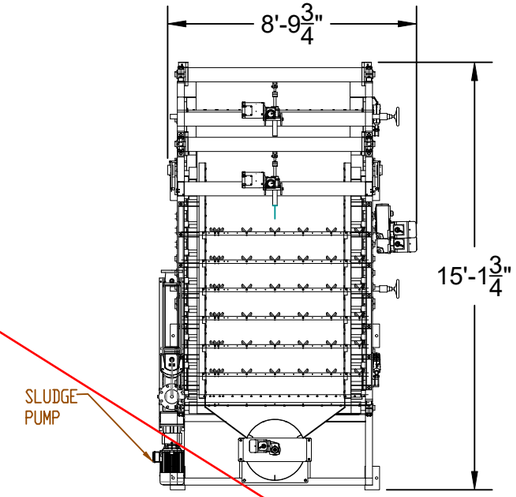
DWG. NO. GEMINI_1700 REF. FROM NITRO SUBMITTAL

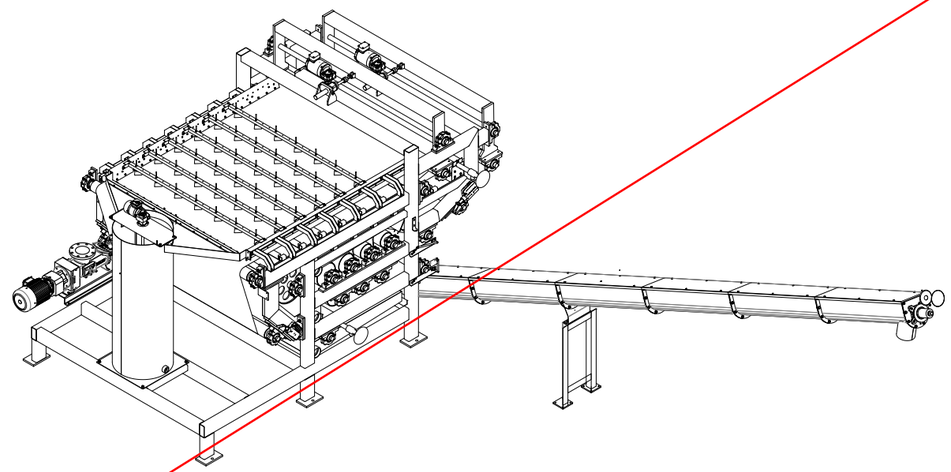
REV: A

PRODUCT LINE

SCALE: 1:60

SHEET 1 OF 1





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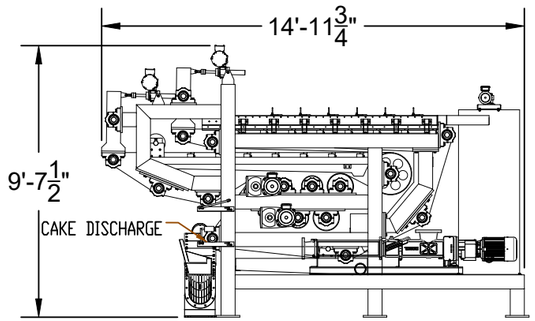

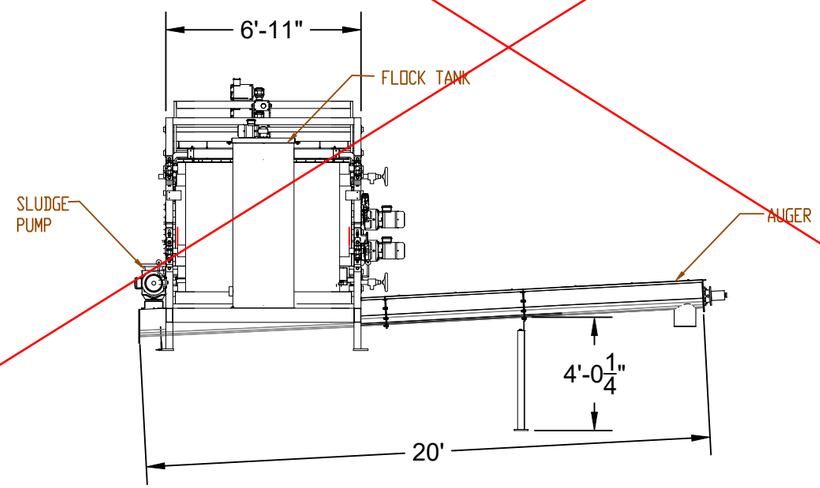

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THREE PLACE DECIMAL ±.010

	NAME	DATE
DRAWN BY	KP	10/5/21
CHECKED		

TITLE: GEMINI BELT PRESS 1700 SERIES

GENERAL LAYOUT

SIZE B

OR-TEC INCORPORATED
14500 SOUTH INDUSTRIAL RD
MAPLE HEIGHTS, OHIO USA
216-475-5225

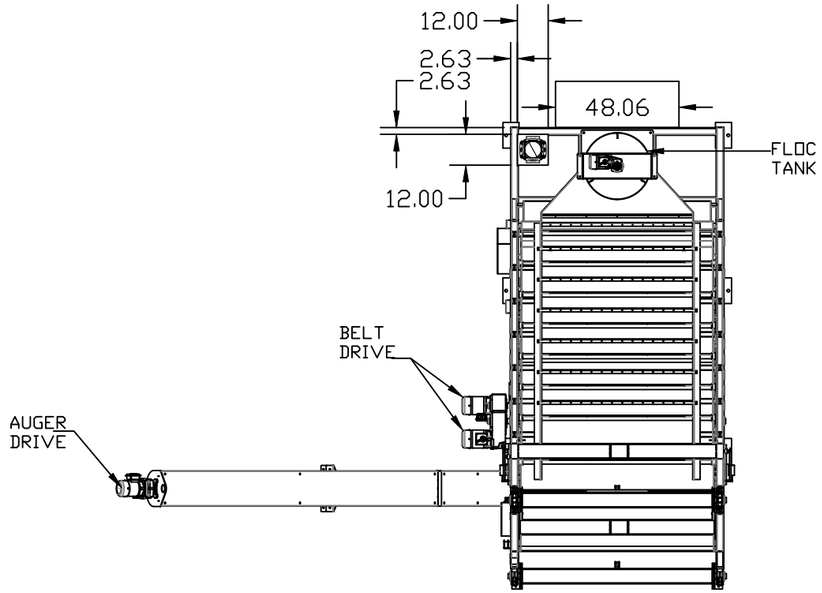
DWG. NO. GEMINI_1700 REF. FROM NITRO SUBMITTAL

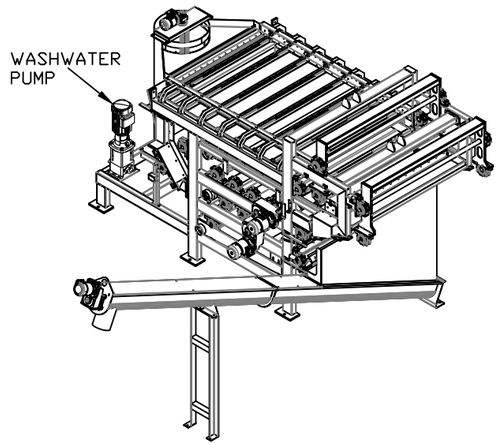
REV: A

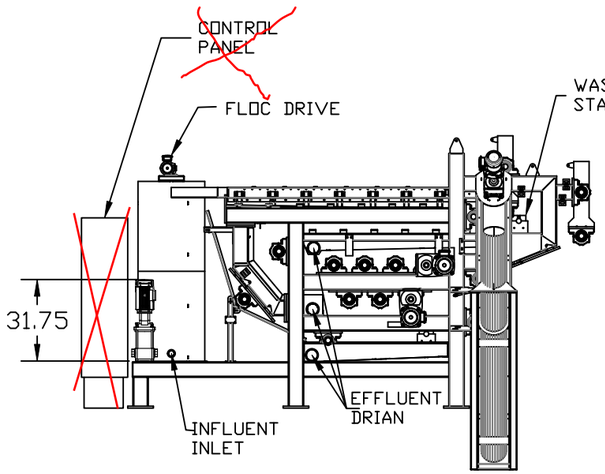
PRODUCT LINE

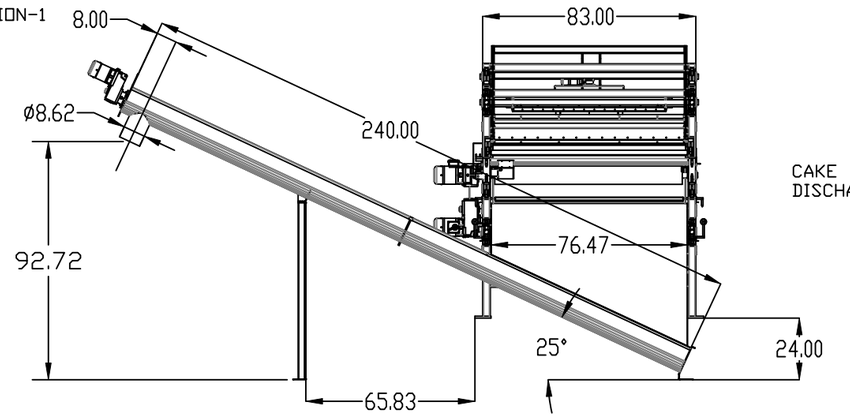
SCALE: 1:60

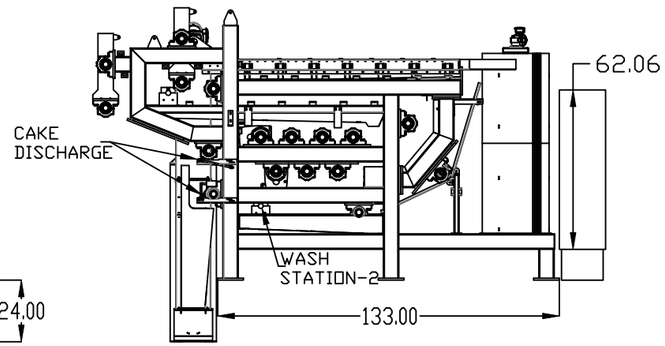
SHEET 1 OF 1











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ONE PLACE DECIMAL ±.1
TWO PLACE DECIMAL ±.03
THREE PLACE DECIMAL ±.010

	NAME	DATE
DRAWN BY	AG	6/7/2022
CHECKED		

TITLE: GEMINI-1.7-WITHAUGER-REV-2

FABRICATION DETAILS

SIZE B

OR-TEC INCORPORATED
5445 DUNHAM RD
MAPLE HEIGHTS, OHIO USA
216-475-5225

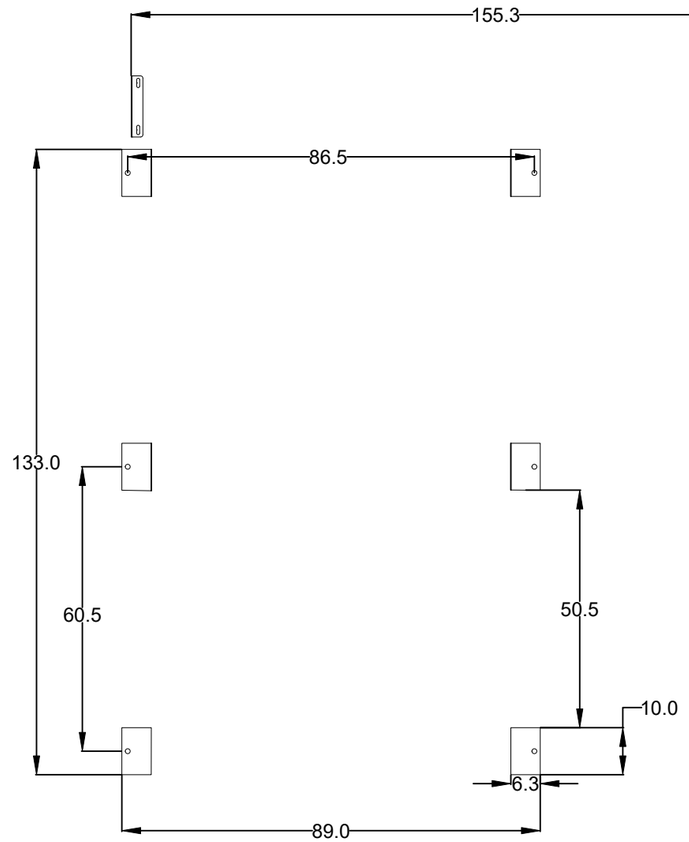
DWG. NO. GEMINI 1.7M-ASSY-WITH-AUGER

REV: A

PRODUCT LINE

SCALE: 1:100

SHEET 1 OF 1



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ONE PLACE DECIMAL ±.1
TWO PLACE DECIMAL ±.03
THREE PLACE DECIMAL ±.010

	NAME	DATE
DRAWN BY	KP	10/5/21
CHECKED		

TITLE: GEMINI BELT PRESS 1700 SERIES

GENERAL LAYOUT

SIZE B

OR-TEC INCORPORATED
14500 SOUTH INDUSTRIAL RD
MAPLE HEIGHTS, OHIO USA
216-475-5225

DWG. NO. GEMINI_1700-FOOTLAYOUT

REV: A

PRODUCT LINE

SCALE: 1:60

SHEET 1 OF 1

PARALLEL HELICAL CLINCHER

PERFORMANCE SPECIFICATIONS

Configuration: offset parallel
Integral motor HP (min./ max.):0.16 / 200
Integral motor kW (min./ max.):0.12 / 160
Typical efficiency:97%
# of gear reductions: 2 to 6

MOUNTING STYLES

Shaft mount housing style: standard
Integral torque tab:standard
B5 flange outside diameter range [in]: 5.51 to 25.98
B5 flange outside diameter range [mm]: 140 to 660
Footed housing style available
B14 flange outside diameter range [in]: 3.94 to 17.72
B14 flange outside diameter range [mm]: 100 to 450

OPTIONS

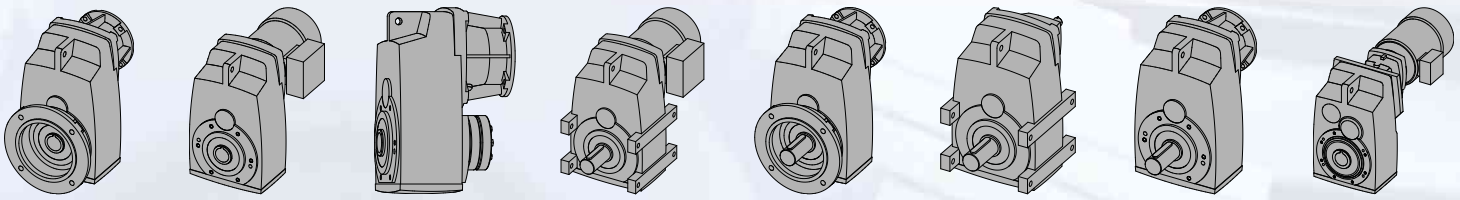
Custom adapter flange
Flange pilot removed
Shock dampeners
Effective drywell with flange

RATIO AND SPEED

Minimum standard ratio: 4.03:1
Maximum standard ratio: 6616.79
Minimum output speed from 1750 rpm motor: 0.26 rpm
Maximum output speed from 1750 rpm motor: 434 rpm

Unit Size	Torque Max.		Ratio Range	Keyed Hollow Shaft Dia.					Solid Shaft Dia.		Shrink Disc Shaft Dia.	
	[lb-in]	[Nm]	min.-max.	Std-[in]	Opt.-[in]	Opt.-[in]	Opt.-[in]	[mm]	[in]	[mm]	[in]	[mm]
SK 0182	1,027	116	4.24 - 81.71	0.750	0.500			25	0.750	25		
SK 0282	1,460	165	4.03 - 139.16	1.000	1.1875	0.750		30	1.000	25	1.188	30
SK 1282	2,620	296	4.79 - 109.50	1.188	1.250	1.000	.0750	30	1.250	30	1.250	30
SK 1382	3,275	370	16.28 - 381.45	1.375	1.4375	1.250		35	1.250	30	1.500	35
SK 2282	4,983	563	4.51 - 127.51	1.438	1.500	1.375	1.250	35	1.375	35	1.500	35
SK 2382	4,983	563	82.22 - 763.41	1.438	1.500	1.375	1.250	35	1.375	35	1.500	35
SK 3282	8,983	1,015	4.48 - 112.23	1.625	1.500	1.438		40	1.875	45	1.625	40
SK 3382	9,195	1,039	89.60 - 1022.42	1.625	1.500	1.438		40	1.875	45	1.625	40
SK 4282	17,700	2,000	4.70 - 155.70	2.062	2.000	1.938	1.688	50	2.250	55	2.000	50
SK 4382	18,381	2,077	86.83 - 1585.08	2.062	2.000	1.938	1.688	50	2.250	55	2.000	50
SK 5282	28,630	3,235	4.32 - 134.03	2.438	2.375	2.188		60	2.500	65	2.500	60
SK 5382	28,320	3,200	82.72 - 1367.08	2.438	2.375	2.188		60	2.500	65	2.500	60
SK 6282	40,152	4,537	4.39 - 80.33	2.750	2.938	2.438		70	3.000	75	3.000	70
SK 6382	53,100	6,000	24.42 - 551.58	2.750	2.938	2.438		70	3.000	75	3.000	70
SK 7282	57,266	6,471	4.26 - 69.73	3.188	3.250	2.938		80	3.500	90	3.188	80
SK 7382	73,455	8,300	22.67 - 338.79	3.188	3.250	2.938		80	3.500	90	3.188	80
SK 8282	93,969	10,618	4.52 - 72.71	4.062	4.000	3.938	3.438	100	4.250	110	4.000	100
SK 8382	116,820	13,200	30.92 - 386.68	4.062	4.000	3.938	3.438	100	4.250	110	4.000	100
SK 9282	158,681	17,930	5.34 - 34.38	4.750	4.938	4.438		120	5.250	140	4.750	125
SK 9382	224,790	25,400	35.61 - 352.36	4.750	4.938	4.438		120	5.250	140	4.750	125
SK 10282	283,200	32.000	5.20 - 18.24					160	6.250	160	6.250	160
SK 10382	329,220	37,200	21.00 - 357.40					160	6.250	160	6.250	160
SK 11282	371,700	42,000	7.67 - 34.85					180	7.000	180	7.000	180
SK 11382	610,650	69,000	31.96 - 224.76					180	7.000	180	7.000	180
SK 12382	796,500	90,000	69.12 - 201.75					180	7.000	180	7.000	180

PARALLEL HELICAL CLINCHER



SHAFT DATA

Input and output shaft material:ASI 1045 or 4140
Input and output shaft key dimensions [in]:according to ANSI B17
Input and output shaft key dimensions [mm]:according to DIN 747
Output shaft drill and tap:standard• number of hollow shaft keys:2
Shrink disc size range [in]:1.188 to 7.000
Shrink disc size range [mm]:30 to 180
Minimum gripping safety factor range [h6 fit]:2.2 to 5.9

OPTIONS

Double solid output shaft
Shaft fixing element
Custom shaft diameters
Hollow spline per DIN 5480
Custom spline
Cross drilled holes
304 stainless steel

MOTOR MOUNTING

Integral motor:1/6 to 250 HP
C-face adapter frame size range:56C to 360TC
IEC adapter (B5) frame size range:IEC 63 to IEC 315
Sugar scoop motor availability:56 to 365T
Top mount platform motor availability:56 to 405T

OPTIONS

Custom motor adapter
Custom coupling diameter

GEARING

Quality rating on gears:up to AGMA Class 13
Minimum hardness of steel gears:58 Rockwell C
Hard finishing of gear teeth:grinding or skive hob
Drop forged gear blanks:standard
Momentary overload capacity:275%
Hunting tooth ratios:standard

HOUSING

Typical housing material:Class 35 gray iron
(smallest sizes have aluminum alloy material)
Machining method:single setup
Main housing design:UNICASE™ one piece
Seal carrier:direct to main housing
Housing torsional stiffness:exceptional
Housing wall section:thick
Casting sealing method:dip seal

BEARINGS

Bearing quality:ABEC-1
Standard output bearing:ball
Heavy-duty output bearing:tapered or spherical

LUBRICANT AND SEALING COMPONENTS

Factory filled lubricant type:ISO 220 mineral oil
(smallest sizes Have synthetic oil as standard)
Typical breather vent style:AUTOVENT (except smallest sizes)
Output seal design:QUADRILIP™ Seal System
Output shaft oil seals:1 double lip and 1 single lip
Oil seal lip material:nitrile rubber
Oil seal to housing gasket:nitrile rubber

OPTIONS

Custom synthetic lubricating oil
Custom temperature lubricating oil
Fluid grease lubricant
Food grade lubricating oil
Long term storage preparation
Magnetic drain plug
Bullseye sight glass
Custom drain plug
Fluorinated rubber oil seal material
Custom oil seals

INTERNAL PARTS ASSEMBLY

Assembly method:heavy press fit
Reversing duty:standard
Typical backlash range [arc minutes]:6 to 11

OPTIONS

Internal backstop

ENVIRONMENTAL PROTECTION

Exterior primer coverage:all metal exterior surfaces
Paint type:Water Based Resin
Paint additive:316 stainless steel flakes
USDA incidental contact exposure:H1

OPTIONS

NSD+ protection
Custom paint
High pressure washdown IP66 oil seals
Shaft seal covers

MECHANICAL VARIABLE SPEED COMPATIBILITY

HP range with TITAN™ belt box:0.33 to 150
Speed range with TITAN™ belt box:6.1 to 883
HP range with NORDISC®traction drive:0.25 to 7.5
Speed range with NORDISC®traction drive:0.3 to 485

www.nord.com

NORD Gear Corporation
National Customer Service Toll-Free: 888.314.6673
info.us@nord.com

NORD Gear Limited
Toll-Free in Canada: 800.668.4378
info.ca@nord.com

WEST
Corona, CA (Los Angeles)
Phone: 608.849.0190

MIDWEST
Waunakee, WI (Madison)
Phone: 608.849.7300

EAST
Charlotte, NC
Phone: 608.849.0140

CANADA
Brampton, ON (Toronto)
Phone: 905.796.3606

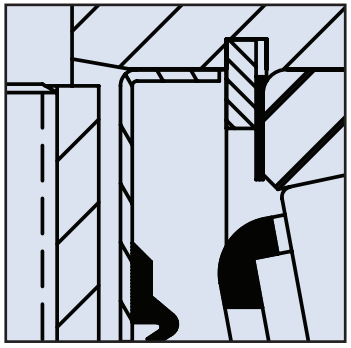
10020001B/0508

The Original DODGE TYPE E Bearings, Only Be

Complete Family of General-Purpose, High-Capacity Tapered Roller Bearings

Exclusive DODGE "R" Seal

- Performs Significantly Better Than Other Seals: Dust box tests prove it. The DODGE Type E bearings' "R" seal offers improved bearing protection.



- Test Requirements: Pillow blocks were mounted with different seal designs in an enclosed container. Propeller-type dust slingers were installed on each side of the test bearing.
- Contaminant Medium:: Foundry sand
- LENGTH OF TEST: 300 hours (or until lock-up occurred)
- SHAFT SPEED: 200 RPM
- Approximate Revolutions: 3.6 million

All Type E Bearings Share Common Features That Ensure Greater Reliability

- High-capacity TIMKEN™ tapered roller bearing inserts allow for combination radial and thrust loads.
- Exclusive DODGE "R" seal protects against contamination in dusty or damp environments.
- Nitrile rubbing lip seal conforms to the TIMKEN cone, permits grease to purge while keeping contaminants out.
- Optional E-Tect seal kit gives extra protection, reduces contamination for longer bearing life.
- DODGE Springlok 65° setscrew locking system offers the optimum balance between locking force and collar stress.
- True rolling motion and surface contact over the complete length of the tapered roller results in higher load capacity.
- Oversized dual Spinglok collars act as flingers for added protection.
- Bearings are preassembled, pre-lubricated, and factory adjusted for easy installation and maximum production efficiency.
- Quality case-hardened rollers and racers offer excellent load handling.
- Hardened outer surface resists wear.
- Ductile interior absorbs shocks and resists crack propagation.
- Variety of configurations allows maximum application flexibility.
- Approximate revolutions: 3.6 million

DODGE®

Type E

- Two- and four-bolt pillow blocks (1-3/16" through 7" and 35 mm through 180 mm)
- Flange (1-3/16" through 4-1/2" and 35 mm through 115 mm)
- Piloted flange (1-3/16" through 5" and 35 mm through 125 mm)
- Top angle take-ups (1-3/4" through 4" and 45 mm through 100 mm)
- Center pull frame with wide slot take-up (1-3/8" through 3" and 35 mm through 75 mm)

Type K Fits Where Others Won't

The DODGE Type K bearing is ideal for light-to-moderate loads and for applications with the need for a statically self-aligning and expansion-capable bearing. It is specifically designed for small space requirements and is offered in a variety of configurations.

- Pillow block—expansion and non-expansion (1-3/16" through 3-15/16")
- Flange—expansion and non-expansion (1-3/16" through 3-15/16")
- S-1 and B-1units (1-3/16" through 3-15/16")
- Wide slot take-up frame (1-3/8" through 3")
- Top angle take-ups (1-3/4" through 3-15/16")

TAF is Dimensionally Interchangeable with SAF Pillow Blocks

DODGE TAF bearings are a cost-effective alternative to SAF bearings. Compared with standard SAF pillow blocks, these bearings save installation time, reduce lubrication costs, and are shipped shaft ready.

- Interchangeable with SAF-style pillow blocks (1-7/16" up to 7" 35 mm through 180 mm)

DOUBLE-INTERLOCK® Combines Durability with Mounting Flexibility

DODGE DOUBLE-INTERLOCK bearings have a split housing design with a replaceable inner unit for application versatility.

This durable twin-row tapered roller bearing features excellent self-aligning characteristics and is offered in expansion and non-expansion constructions.

- Two- and four-bolt pillow blocks (1-3/16" through 7" and 35 mm through 180 mm)
- Flange (1-3/16" through 5" and 35 mm through 125 mm)
- S-1 unit (1-3/16" up to 7" and 35 mm through 180 mm)
- B-1 unit (1-3/16" up to 5" and 35 mm through 125 mm)
- D unit (1-3/16" up to 5")

DODGE®

Only the Best Bearings Come from the Best Plant

Our DODGE® Type E, S-2000 and S-2000-E, and IMPERIAL® and IMPERIAL-E bearings are the best. Not only because they are manufactured at our Marion, NC, plant—one of IndustryWeek's Top 10 Best Plants for 2004—but because they represent the best in roller bearing technology and innovation.

When you want the best bearings, look to DODGE and our Best Plant in Marion, NC. Together, they are your best source for performance-proven solutions.

DODGE Type E Bearings

The Standard Against Which All Other Bearings Are Compared

There is only one name that is synonymous with the finest-quality mounted tapered roller bearings in the industry. For decades, industry's leading producers have depended on Rockwell Automation's DODGE® Type E family of bearings to handle their conveyance and power transmission needs.

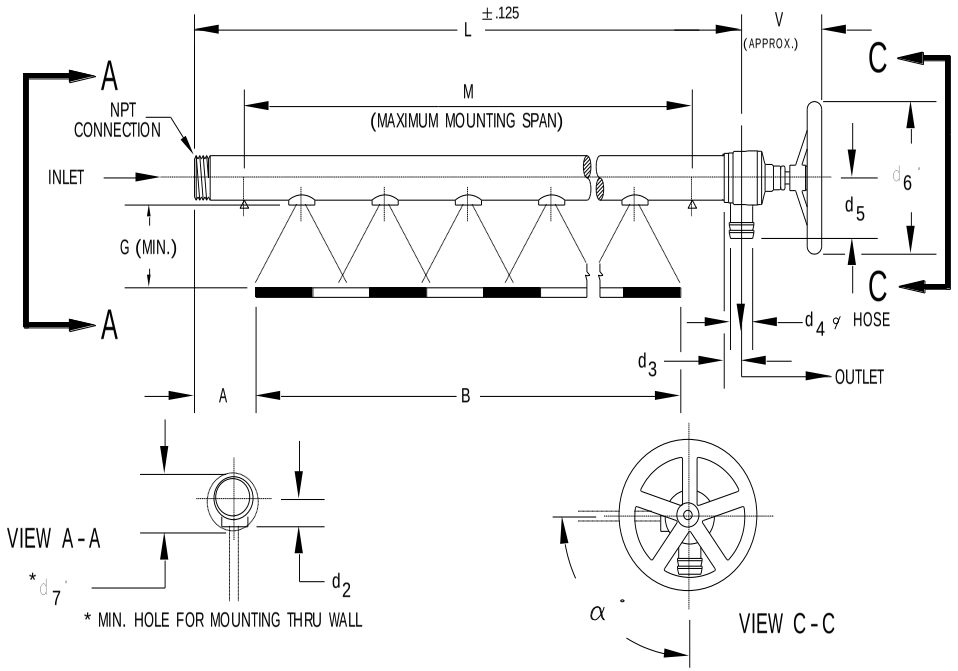
The original Type E bearing was developed by DODGE in the 1950's. This economical, heavy-duty tapered roller bearing fast became known as the standard of the industry and the bearing users could trust.

Throughout the years, its reputation for dependability has remained. And now — through extensive research and onsite operation — its innovation and engineering have evolved into a family of reliable products that not only assure better performance and longer life, but offer greater value, as well.

DODGE®

LECHLER, INC.
445 Kautz Road
St. Charles, IL 60174
1-800-777-2926

MODEL NO. 1
WITH
NPT MALE THREAD
ON LIQUID INLET



LECHLER / STAMM

Shower header with built-in cleaning device features a special flush-out valve directly linked to a self-supported brush which cleans inside of the pipe and nozzle orifices by turning the handwheel.

MATERIALS

Nozzles, valve housing in 316 SS. Retainers in 17-4PH. Gaskets & seals in Buna/PolyP, Valve bushing in Bronze/Brass, all other parts in 300 series Stainless Steel.

CUST. APPROVAL

DATE

All dimensions are in inches

*Q MAX. is maximum capacity in GPM

PART NUMBER:	S01464.1Y.15014
DATE:	2/4/2003
CUSTOMER:	OR-TEC
COMMENTS:	1.5 MACHINE
REF. NUMBER:	ORIOH003
MATERIAL:	316L SS
PIPE SIZE:	1-1/2"
FEATURES:	
LENGTH (L):	80.44"
SPRAY WIDTH (B):	60.00"
SPRAY HEIGHT (G):	2.50"
INLET END TO EDGE OF SPRAY(A):	9.16"
ANGLE (α°) NOZZLE TO OUTLET:	0°
INLET CONN:	1-1/2" NPT
OUTLET CONN:	HOSE BARB
NOZZLES:	
PART NUMBER:	626464.1F.37
FLOW RATE (GPM):	0.50
PRESSURE (PSIG):	40
SPRAY ANGLE:	60°
QUANTITY OF NOZZLES:	24
TOTAL FLOW (GPM):	12

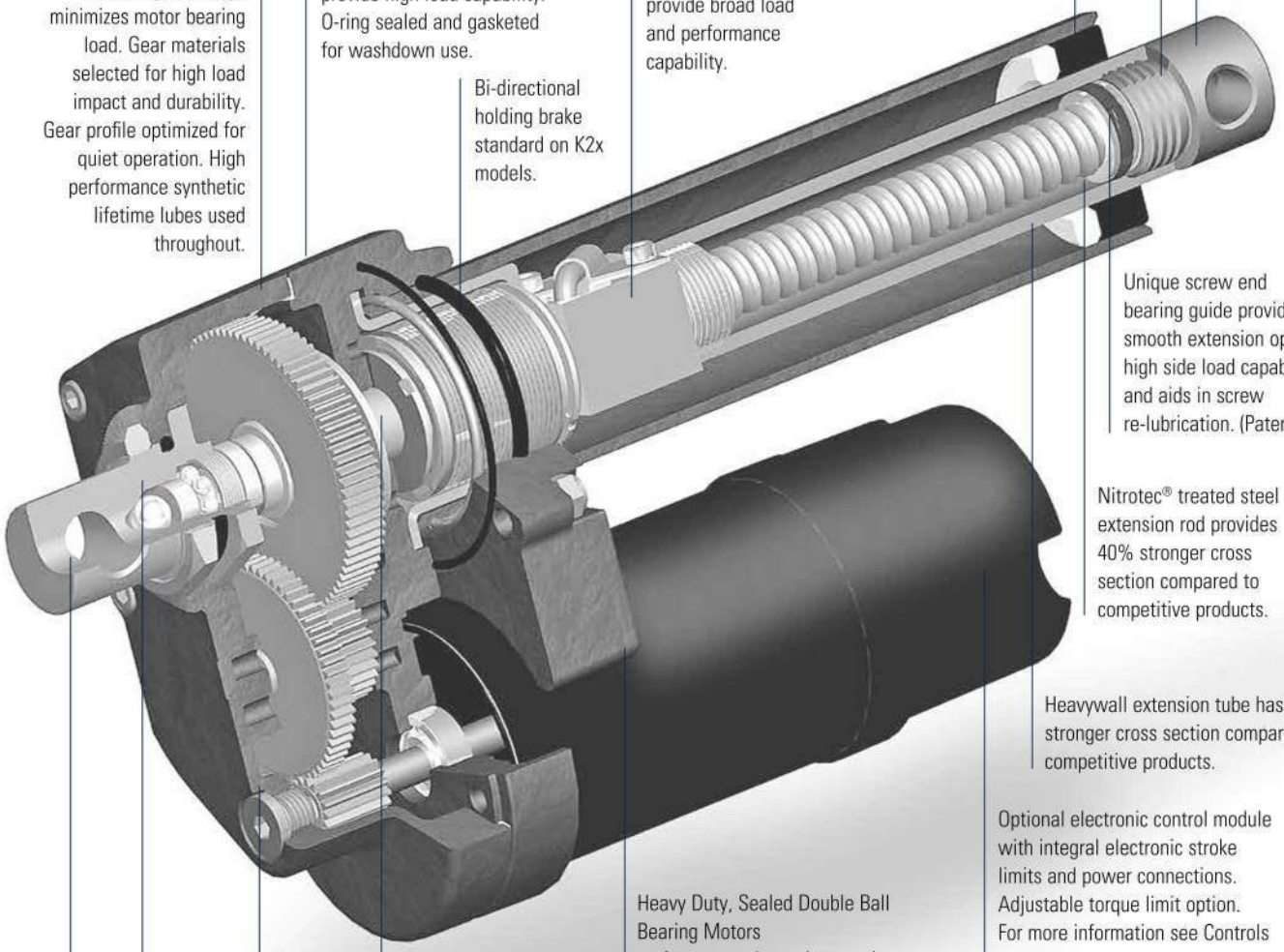
PIPE SIZE	V(CLOSED)	V(OPEN)	d2	d3	d4	d5	d6	d7	M MAX	*Q MAX	PSI MAX	BAR MAX
1-1/2"	6.00	7.00	1.40	1.62	1-1/2"	3.00	8"	2.75	100"	55	200	14
2"	6.00	7.00	1.64	1.62	1-1/2"	3.00	8"	3.25	180"	90	1000	70
2-1/2"	7.00	8.00	1.88	1.50	2"	4.00	12"	3.75	230"	130	1000	70
3"	7.00	8.00	2.19	1.50	2"	4.25	12"	4.50	280"	210	900	62
4"	7.25	8.50	2.69	2.00	2-3/4"	5.75	15"	5.38	320"	340	700	48
5"	7.25	8.50	3.34	2.00	2-3/4"	6.50	18"	6.375	360"	445	700	48
6"	7.25	8.50	3.88	2.00	2-3/4"	7.00	18"	7.375	400"	560	700	48

Rugged Duty Actuators

Key Features
- Weather-tight sealed
- Patented in-line load transfer
- Heavy wall rod and cover tube
- High performance motors
- Up to 2,800 lb. (12455 N) capacity
- Speeds up to 2" per second

Standard Models
K2VL, K2, K2X, K2AC, K2XAC

Option Models
K2PL/K2XPL
K2JS/K2XJS
K2RA



Threaded rod connection allows optional end fittings.

Nitrotec® treated end fitting for superior strength and corrosion resistance.

Hydraulic Cylinder type Rod Wiper Seal with integral extension rod bearing support for smooth operation and high side load capability.

High strength aluminum gear box provides maximum heat dissipation. High strength stainless thru-bolt fasteners provide high load capability. O-ring sealed and gasketed for washdown use.

Ball bearing, Bronze or Delrin® screw nut configurations provide broad load and performance capability.

Efficient gear design minimizes motor bearing load. Gear materials selected for high load impact and durability. Gear profile optimized for quiet operation. High performance synthetic lifetime lubes used throughout.

Bi-directional holding brake standard on K2x models.

Unique screw end bearing guide provides smooth extension operation, high side load capability and aids in screw re-lubrication. (Patented)

Nitrotec® treated steel extension rod provides 40% stronger cross section compared to competitive products.

Heavywall extension tube has 30% stronger cross section compared to competitive products.

Optional electronic control module with integral electronic stroke limits and power connections. Adjustable torque limit option. For more information see Controls Section.

Heavy Duty, Sealed Double Ball Bearing Motors
- Auto reset thermal protection
- Easy field replacement
- 12, 24, 48 or 90 volts (vdc) available (others available on request)
- Standard Packard 56 connector, others available
- Washdown sealed
- Solid mount pinion gear
- Lifetime bearing lube

Integrated manual override – standard

Mechanical torque limiter for end of stroke and overload protection.

Patented in-line design transfers loads to the end fitting via ball bearing screw pivot. Efficient load transfer reduces noise and current draw.

Nitrotec® treated end fittings with integral O-ring seals for superior weather and corrosion resistance. 6 available mounting orientations.

How To Select

Step 1 – Determine Load and Stroke length requirements
Use the Quick Selection guide to identify the model family that will provide the load capacity and stroke length needed for your application.

Step 2 – Determine Gear Ratio
Select gear ratio from performance charts for allowable current draw and needed load.

Step 3 – Identify motor type and voltage
Select DC motor and motor voltage.

Step 4 – Motor Type
Select M for ignition protected motor (12 VDC only).
Select needed motor voltage.

Step 5 – Confirm the application Duty Cycle
At full load capacity, actuators have a 25% duty cycle. Duty cycle is the amount of 'on-time' compared to cooling time. A unit that runs for 15 seconds should be off for 45 seconds.

Step 6 – Select Nut Type
Select nut for unit selected. (K2x are all ball bearing).

Step 7 – Select Stroke Length
Choose standard lengths from chart. For special length consult factory.

Step 8 – Select end fitting orientation
Leave blank for standard orientation.

Important Unit Restrictions

Side loading and shock loads must be considered in actuator applications. Side loading and cantilevered mounting should be eliminated through proper machine design. Side loading will dramatically reduce unit life. While actuators can withstand limited shock loads, it is recommended that shock loading be avoided wherever possible. (See page 71)

B-Track Configurator

K2x – P1.x – G20 – 12V – M – BR – 04 – R120

Actuator Model No.
K2x
K2
K2VL

Gear Ratio
G30 = 30:1
G20 = 20:1
G10 = 10:1
G05 = 5:1

Nut Type*
Blank–K2x
BR – Bronze Nut
BRL – Bronze Nut - Long
DN – Delrin® Nut
*BRL matches K2x pin to pin

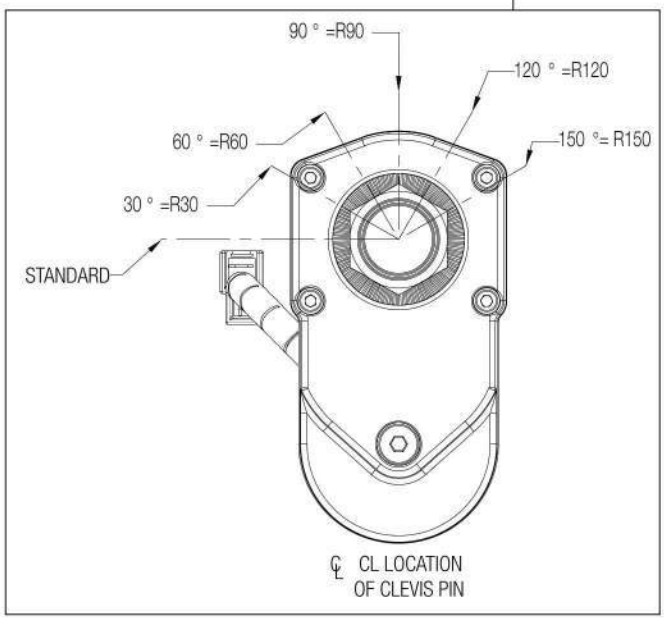
Stroke Length
04 – 4.00 (100 mm)
06 – 6.00 (150 mm)
08 – 8.00 (200 mm)
12 – 12.00 (300 mm)
18 – 18.00 (450 mm)
24 – 24.00 (600 mm)

Base Fitting Alignment
Blank–Standard
R30 – 30° Fitting
R60 – 60° Fitting
R90 – 90° Fitting
R120 –120° Fitting
R150 –150° Fitting

Control Model
P1.x Fixed Limit Switch
P2.x Position Feedback
EP1.x Adjustable Limit Switches
RP Low Switching (K2VL Not Available)
Note: See control pages for full listing of model numbers.

Motor Voltage
12V – 12 volts
24V – 24 volts
36V – 36 volts
48V – 48 volts
90V – 90 volts
115V – 115 volts
230V – 230 volts

Motor Type
M – Ignition Protected Motor
For standard motor, leave blank.

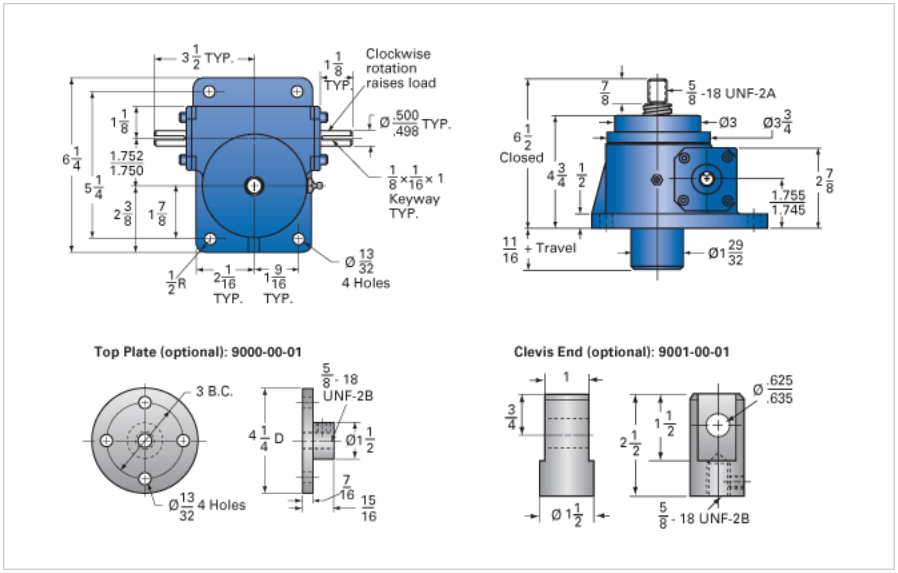


Scan to watch!
Linear Actuator Basic Selection Video
https://p.widencdn.net/ydtpk6

ActionJac 2.5-MSJ-UK 24:1

Call 800-321-7800 or visit us online at www.nookindustries.com to configure and order your ActionJac 2.5-MSJ-UK 24:1 today!

2D/3D CAD ONLINE



Details	
Capacity [Ton]	2.5
Gear Ratio	24:1
Turns of Worm per Inch Travel	96
Torque to Raise 1 lb. [in-lb]	0.0122
Lifting Screw Diameter [in]	1.00
Screw Lead [in]	0.250
Root Diameter [in]	0.698
Tare Drag Torque [in-lb]	5
Performance Specifications	
Maximum Allowable Input [hp]	0.50
Maximum Input Torque [in-lb]	53
Maximum Worm Speed at Rated Load [rpm]	516
Maximum Load at 1750 RPM [lb]	1476
Starting Torque	2 x Running Torque
Weight	
Base 0 Travel [lb]	17
Per Inch of Travel [lb]	0.45
Grease [lb]	0.5

HIGH-ACCURACY MINIATURE UNIVERSAL LOAD CELLS 51 mm (2") DIAMETER, DUAL STUD MOUNT STYLE
STANDARD AND METRIC MODELS

Tension/Compression
Calibrated in Tension
0-25 lb to 0-10,000 lb
0-11 kgf to 0-4537 kgf

1 Newton = 0.2248 lb
1 daNewton = 10 Newtons
1 lb = 454 g
1 t = 1000 kgf = 2204 lb

STANDARD
LC203-100, shown actual size.

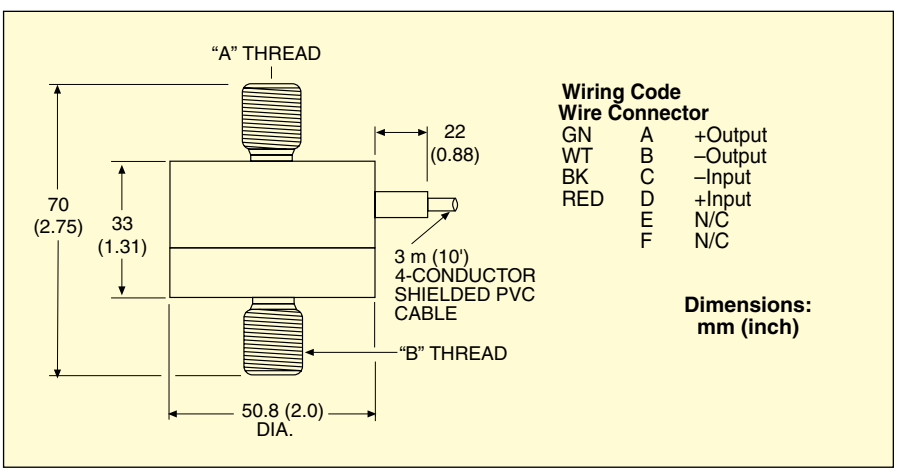
METRIC
LCM213-2KN, shown actual size.

LC203/LCM203 Series
LC213/LCM213 Series

MADE IN USA NIST RoHS
Standard

- **0.25% Interchangeability for Scale Applications**
- **Hermetically Sealed**
- **Miniature Package for Test Stands and Difficult Locations**
- **Heavy-Duty Construction**
- **5-Point Calibration**

OMEGA's LC203/LCM203 Series comprises high-accuracy, miniature, low-profile industrial load cells that come with a stud at each end for easy in-line mounting. The tough, corrosion-resistant steel construction and high-accuracy strain gages make them suitable for most industrial weighing applications.



Dimensions: mm (inch)

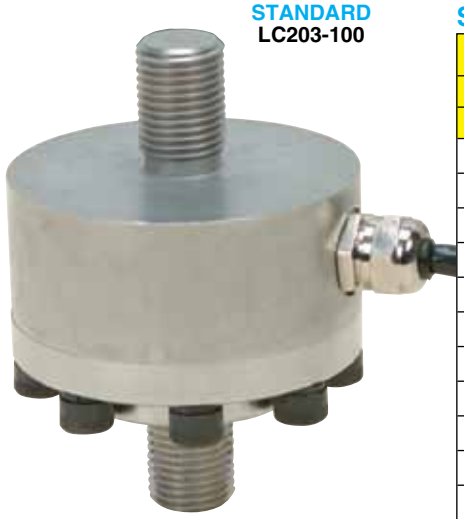
MODEL	A THREAD	B THREAD
LC203	½-20 UNF	½-20 UNF
LCM203	M12 x 1.75	M12 x 1.75
Thread Length	19 (0.75)	17 (0.69)

SPECIFICATIONS

Excitation: 10 Vdc, 15 Vdc maximum
Output: 2 mV/V ±0.25%
5-Point Calibration (in Tension): 0%, 50%, 100%, 50%, 0%
Linearity: ±0.15% FSO
Hysteresis: ±0.1% FSO
Repeatability: ±0.05% FSO
Zero Balance: ±2% FSO
Deflection: 0.025 to 0.075 mm (0.001 to 0.003")
Protection Class: IP65
Operating Temp Range: -46 to 107°C (-50 to 225°F)
Compensated Temp Range: 16 to 71°C (60 to 160°F)
Thermal Effects:
Zero: 0.006% FSO/°C
Span: 0.009% FSO/°C
Safe Overload: 150% of capacity
Ultimate Overload: 300% of capacity
Input Resistance: 360 Ω minimum
Output Resistance: 350 ±10 Ω
Construction: Stainless steel
Electrical: 3 m (10') 4-conductor PVC shielded cable
LC213/LCM213 Mating Connector: PT06F10-6S (sold separately)

HIGH-ACCURACY MINIATURE UNIVERSAL LOAD CELLS
51 mm (2") DIAMETER, DUAL STUD MOUNT STYLE

STANDARD
LC203-100

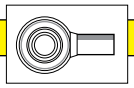


STANDARD MODELS

To Order *Visit omega.com/lc203 for Pricing and Details*

CAPACITY		MODEL NO.		
lb	kgf	CABLE	CONNECTOR	COMPATIBLE METERS**
25	11	LC203-25	LC213-25	DPiS, DP41-S, DP25B-S
50	23	LC203-50	LC213-50	DPiS, DP41-S, DP25B-S
100	45	LC203-100	LC213-100	DPiS, DP41-S, DP25B-S
200	91	LC203-200	LC213-200	DPiS, DP41-S, DP25B-S
300	136	LC203-300	LC213-300	DPiS, DP41-S, DP25B-S
500	227	LC203-500	LC213-500	DPiS, DP41-S, DP25B-S
1000	455	LC203-1K	LC213-1K	DPiS, DP41-S, DP25B-S
2000	909	LC203-2K	LC213-2K	DPiS, DP41-S, DP25B-S
2500	1134	LC203-2.5K	LC213-2.5K	DPiS, DP41-S, DP25B-S
5000	2269	LC203-5K	LC213-5K	DPiS, DP41-S, DP25B-S
8000	3630	LC203-8K	LC213-8K	DPiS, DP41-S, DP25B-S
10,000	4537	LC203-10K	LC213-10K	DPiS, DP41-S, DP25B-S

ACCESSORIES



MODEL NO.	DESCRIPTION
REC-012F	Rod end for LC203/LC213
PT06F10-6S	Mating connector for LC213 series load cells
CA-4PC24-2-015	Cable assembly with twist-lock connector for LC213 series load cells

Comes complete with 5-point NIST-traceable calibration and 59 kΩ shunt data.
DPiS meter suitable for one direction measurement only.
Ordering Examples: LC203-500, *500 lb capacity cable style, dual stud mount load cell.*
LC213-2K, *2000 lb capacity connector style, dual stud mount load cell,* ***PT06F10-6S,*** *mating connector.*

METRIC
LCM213-2KN

All models shown slightly smaller than actual size.

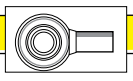
METRIC MODELS

To Order *Visit omega.com/lcm203 for Pricing and Details*

CAPACITY		MODEL NO.		
N	lb	CABLE	CONNECTOR	COMPATIBLE METERS**
100	22	LCM203-100N	LCM213-100N	DPiS, DP41-S, DP25B-S
200	45	LCM203-200N	LCM213-200N	DPiS, DP41-S, DP25B-S
500	112	LCM203-500N	LCM213-500N	DPiS, DP41-S, DP25B-S
1000	225	LCM203-1KN	LCM213-1KN	DPiS, DP41-S, DP25B-S
2000	450	LCM203-2KN	LCM213-2KN	DPiS, DP41-S, DP25B-S
5000	1124	LCM203-5KN	LCM213-5KN	DPiS, DP41-S, DP25B-S
10,000	2248	LCM203-10KN	LCM213-10KN	DPiS, DP41-S, DP25B-S
20,000	4496	LCM203-20KN	LCM213-20KN	DPiS, DP41-S, DP25B-S*
50,000	11,241	LCM203-50KN	LCM213-50KN	DPiS, DP41-S, DP25B-S*

METRIC
LCM203-100

ACCESSORIES



MODEL NO.	DESCRIPTION
MREC-M12F	Rod end for LCM203/LCM213
PT06F10-6S	Mating connector for LCM213 series load cells
CA-4PC24-2-015	Cable assembly with twist-lock connector for LCM213 series load cells

Comes complete with 5-point NIST-traceable calibration and 59 kΩ shunt data.
*** 4-digit meters. ** Visit omega.com for compatible meters.*
Ordering Examples: LCM203-500N, *500 Newton capacity dual stud-mount load cell.*
MREC-M12F, *accessory rod end.*

National Filter Media / ***Filter Belts Division***
12 Winada Drive, Winthrop, ME 04364
Tel: 207-377-2626 Fax: 207-377-2629
1-800-321-5223
www.nfm-filter.com

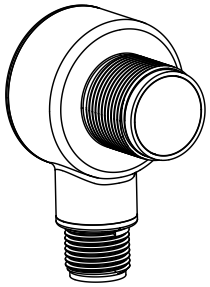
DATA SHEET
FOR SPIRAL WEAVE BELTING

STYLE:	**194-245-450/194-243-400**
FIBER MATERIAL:	**PET**
COLOR:	**WHITE/YELLOW**
MESH COUNT: (PER INCH)	**17 x 5**
FABRIC WEIGHT:	**53 OZ. SQ. YD.**
YARN SIZE:	**.68 mil X .9 mil**
FABRIC THICKNESS: (INCHES)	**0.105**
TENSILE STRENGTH:	**1560 PLI**
CFM :	**450 – 500**
MICRON RETENSION:	**800 - 900**
EDGES:	**HEAT SEALED**

T18-2 Epoxy Encapsulated Right-Angle Sensor

Datasheet

Next Generation of Self-Contained dc-Operated Sensors



- Complete family of sensors, all housed in the compact right angle 18 mm threaded housing designed for long service life in wet environments
- ECO-Lab certified chemically robust epoxy encapsulated plastic sensors for wash-down applications typically found in the food and beverage industry
- Epoxy encapsulation of electronics provides a redundant seal in addition to plastic ultrasonic weld joints for maximum reliability in wet thermal shock environments
- Permanent laser etched product marking will not wear off after repeated cleaning cycles
- Food grade plastic materials used for all exposed surfaces
- Hygienic shape for easier cleaning of the sensor
- Powerful and bright visible red emitter beam for easy alignment and set-up
- Highly visible output and dual-function power and stability indicators
- Advanced ASIC technology makes sensor resistant to optical and electrical noise source
- Wide operating temperature range: –40 °C to +70 °C (–40 °F to +158 °F)

WARNING: Not To Be Used for Personnel Protection
Never use this device as a sensing device for personnel protection. Doing so could lead to serious injury or death. This device does not include the self-checking redundant circuitry necessary to allow its use in personnel safety applications. A sensor failure or malfunction can cause either an energized or de-energized sensor output condition.

Models

Integral 4-pin M12/Euro-style quick disconnect models are listed.

- To order the 2 m (6 ft) cable model, replace the suffix "-Q8" with "-2M"
- To order the 9 m (30 ft) cable model, replace the suffix "-Q8" with "-9M"

Models with a quick disconnect require a mating cordset.

Emitter Models				
Visible Red Models	**Infrared Models**	**Type**	**Range**	**Output**
T18-2NAEL-Q8	T18-2NAELIR-Q8	Emitter	25 m (82 ft)	None
T18-2NAEJ-Q8	T18-2NAEJIR-Q8		25 m (82 ft) with beam inhibit	
T18-2NAES-Q8	T18-2NAESIR-Q8		25 m (82 ft) with adjustment	

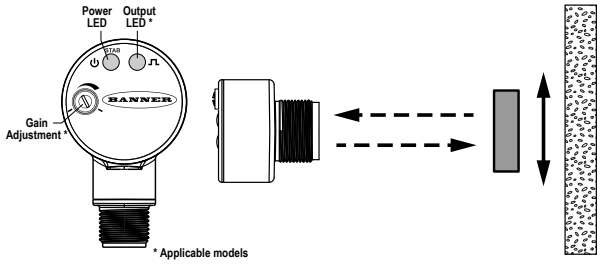
Receiver Models		
Model	**Range**	**Output**
T18-2VNRL-Q8	25 m (82 ft)	Complementary NPN
T18-2VPRL-Q8		Complementary PNP
T18-2VNRS-Q8	25 m (82 ft) with adjustment	Complementary NPN
T18-2VPRS-Q8		Complementary PNP

Polarized Retroreflective Models		
Model	**Range**	**Output**
T18-2VNLP-Q8	6 m (19.7 ft) with BRT-84 reflector	Complementary NPN
T18-2VPLP-Q8		Complementary PNP
T18-2VNLPC-Q8	6 m (19.7 ft) with BRT-84 reflector, with adjustment	Complementary NPN
T18-2VPLPC-Q8		Complementary PNP

Diffuse Models			
Models with Red Emitters	**Models with Infrared Emitters**	**Range**	**Output**
T18-2VNDL-Q8	T18-2VNDLIR-Q8	750 mm (29.5 in) with adjustment	Complementary NPN
T18-2VPDL-Q8	T18-2VPDLIR-Q8		Complementary PNP
T18-2VNDS-Q8	–	300 mm (11.8 in) with adjustment	Complementary NPN
T18-2VPDS-Q8	–		Complementary PNP

Fixed Field Models			
Models with Red Emitters	**Models with Infrared Emitters**	**Range**	**Output**
T18-2VNFF30-Q8	T18-2VNFF30IR-Q8	30 mm	Complementary NPN
T18-2VPFF30-Q8	T18-2VPFF30IR-Q8		Complementary PNP
T18-2VNFF50-Q8	T18-2VNFF50IR-Q8	50 mm	Complementary NPN
T18-2VPFF50-Q8	T18-2VPFF50IR-Q8		Complementary PNP
T18-2VNFF75-Q8	T18-2VNFF75IR-Q8	75 mm	Complementary NPN
T18-2VPFF75-Q8	T18-2VPFF75IR-Q8		Complementary PNP
T18-2VNFF100-Q8	T18-2VNFF100IR-Q8	100 mm	Complementary NPN
T18-2VPFF100-Q8	T18-2VPFF100IR-Q8		Complementary PNP
T18-2VNFF150-Q8	T18-2VNFF150IR-Q8	150 mm	Complementary NPN
T18-2VPFF150-Q8	T18-2VPFF150IR-Q8		Complementary PNP
T18-2VNFF200-Q8	T18-2VNFF200IR-Q8	200 mm	Complementary NPN
T18-2VPFF200-Q8	T18-2VPFF200IR-Q8		Complementary PNP

Installing the T18-2 Epoxy Encapsulated Right-Angle Sensor

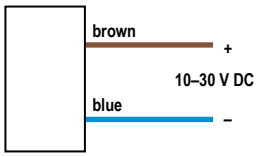


To install the T18-2 Epoxy Encapsulated Right-Angle Sensor:

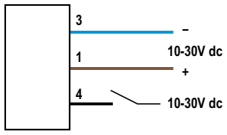
1. Align the sensor as required for the application. For the most sensitive object detection, align the sensor so that the objects move across the sensor's axis.
2. Secure the sensor to a bracket.
3. Wire sensor as shown in the wiring diagrams.
4. Adjust the gain adjuster (sensitivity pot) if necessary.

Wiring Diagrams

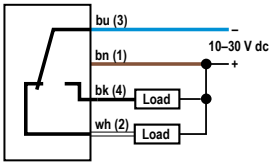
Emitter



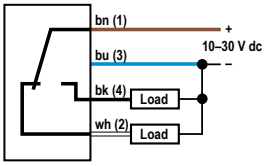
Emitter with Active High Beam Inhibit



Complementary NPN



Complementary PNP



Specifications

Supply Voltage
10 V dc to 30 V dc for ambient temperature ≤ 55 °C
10 V dc to 24 V dc for ambient temperature > 55 °C

Supply Current (Exclusive of Load Current)
All models except FF IR: < 16 mA
FF IR models: < 25 mA

Output Protection Circuitry
Protected against false pulse on power-up and continuous short circuit of outputs. Short circuit protection at elevated temperature may require a power cycle to reset.

Supply Protection Circuitry
Protected against reverse polarity and transient voltages

Output Rating
≤ 50 mA total current for ambient temperatures > 55 °C
≤ 100 mA total current through both outputs ≤ 55 °C
OFF-State Leakage Current: < 50 µA at 30 V dc
ON-State Saturation Voltage: < 1.5 V at 10 mA; < 3.0 V at 100 mA

Output Configuration
Complementary PNP or NPN by model number

Emitter LED
Visible Red on most models
Infrared 850 nm on select models
Infrared fixed-field models provide higher excess gain on green and blue targets

Output Response Time
Response is independent of signal strength
Opposed models: 1.5 milliseconds ON, 1 millisecond OFF
Polarized Retro, and Diffuse models: 1.5 milliseconds ON, 0.75 milliseconds OFF
Fixed Field models: 2 milliseconds ON, 2 milliseconds OFF
Delay on Power-up: 100 milliseconds; outputs do not conduct during this time

Repeatability
Repeatability is independent of signal strength
Opposed models: 300 microseconds
Retro, Polarized Retro, and Diffuse models: 100 microseconds
Fixed Field models: 200 microseconds

Adjustments
Diffuse (DL, DS), Emitter (ES), Receiver (RS), Polarized Retroreflective (LPC) models: Single turn sensitivity (gain) adjustment potentiometer
Emitter Beam Inhibit (EJ) models: Tie black wire to 10 to 30 V dc for beam inhibit

Construction
Housing, M12 QD, and cover: Black or Yellow PBT polyester
Indicator light pipes: Translucent white PMMA (acrylic)
Indicator cover and gain pot driver: PBT polyester
Front window: PMMA

Indicators
Two LEDs (1 green, 1 amber)
Green Solid: Indicates power applied and sensor ready
Green flashing: Indicates marginal sensing signal
Amber solid: Indicates Pin-4 (black wire) conducting

Vibration and Mechanical Shock
All models meet Mil. Std. 202G requirements. Method 201A (Vibration; frequency 10 to 60 Hz, max., double amplitude 0.06 in acceleration 10G). Method 213B conditions H&I (Shock: 75G with unit operating; 100G for non-operation)

Operating Conditions
–40 °C to +70 °C (–40 °F to +158 °F)
95% at +50 °C maximum relative humidity (non-condensing)

Environmental Rating
IEC IP67 per IEC60529
IEC IP68 per IEC60529
IP69K per DIN 40050-9

Certifications

Class 2 power
UL Environmental Rating: Type 1

Chemical compatibility certified

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Required Overcurrent Protection

WARNING: Electrical connections must be made by qualified personnel in accordance with local and national electrical codes and regulations.

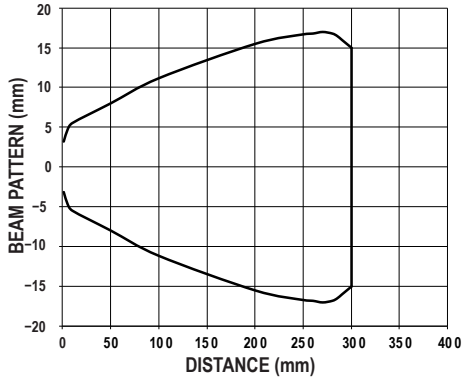
Overcurrent protection is required to be provided by end product application per the supplied table.
Overcurrent protection may be provided with external fusing or via Current Limiting, Class 2 Power Supply.
Supply wiring leads < 24 AWG shall not be spliced.
For additional product support, go to www.bannerengineering.com.

Supply Wiring (AWG)	Required Overcurrent Protection (Amps)
20	5.0
22	3.0
24	2.0
26	1.0
28	0.8
30	0.5

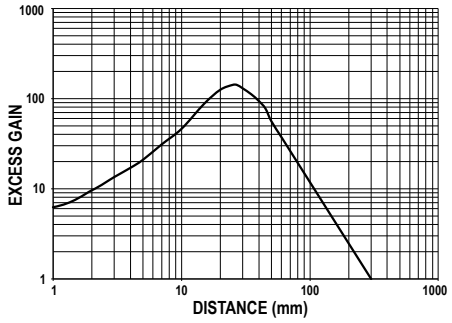
Performance Curves

Diffuse Models (300 mm Range)

Beam Pattern

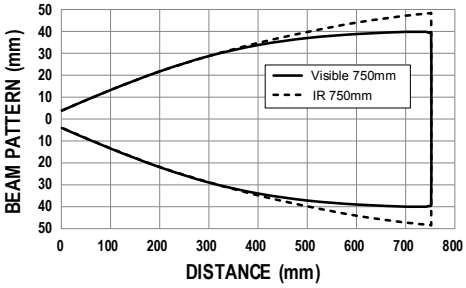


Excess Gain

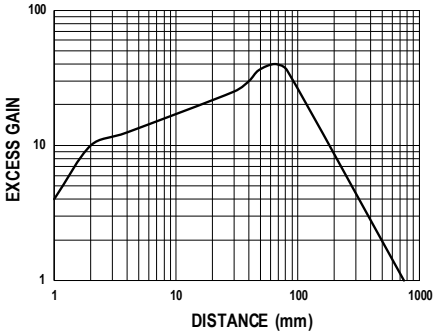


Diffuse Models (750 mm Range)

Beam Pattern



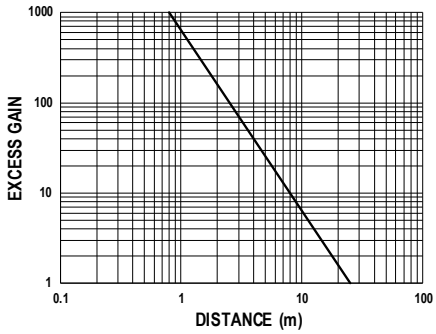
Excess Gain



Emitter/Receiver Models (Effective Beam Size: 15.2 mm)

Beam Pattern

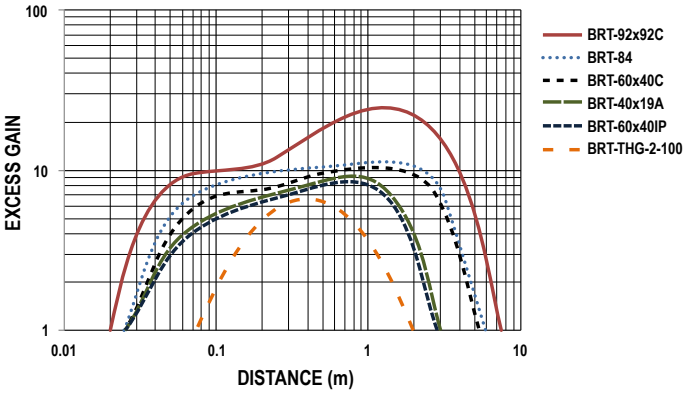
Excess Gain



Polarized Retroreflective Models

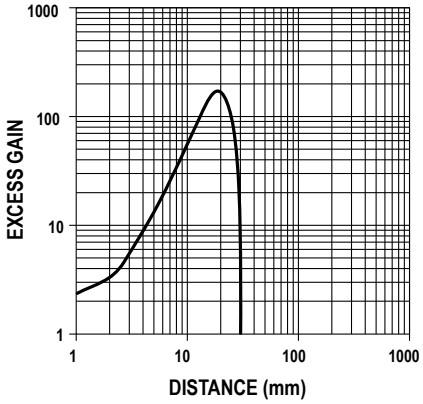
Beam Pattern

Excess Gain

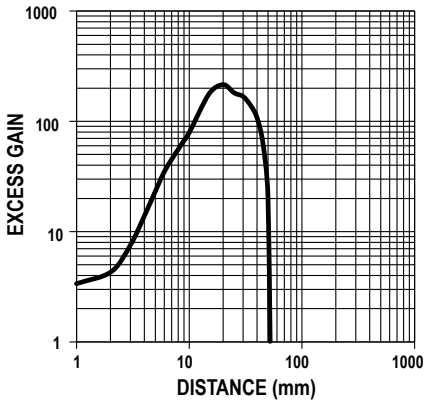


Fixed Field Models - Excess Gain (Applies to both Visible Red and IR models)

Target for Excess Gain Curves use a 90% Reflective White Card



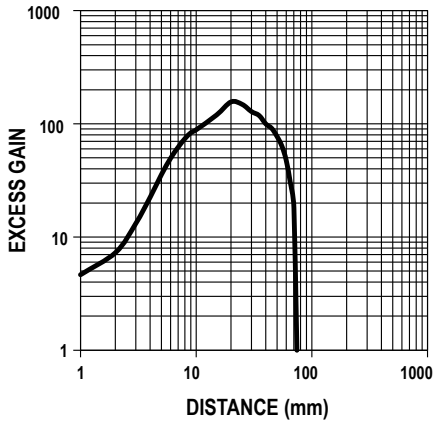
T18-2FF30
Emitter Image Size: 4.0 mm square at 15 mm and 3.5 mm square at 30 mm
18% Gray Test Card: Cutoff distance will be 98% of value shown
6% Black Test Card: Cutoff distance will be 95% of value shown



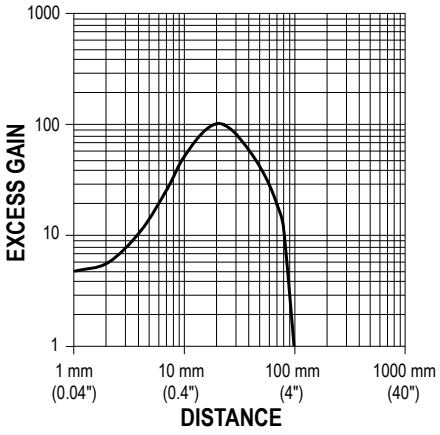
T18-2FF50
Emitter Image Size: 4 mm square at 25 mm and 3 mm square at 50 mm
18% Gray Test Card: Cutoff distance will be 98% of value shown
6% Black Test Card: Cutoff distance will be 95% of value shown

Fixed Field Models - Excess Gain (Applies to both Visible Red and IR models)

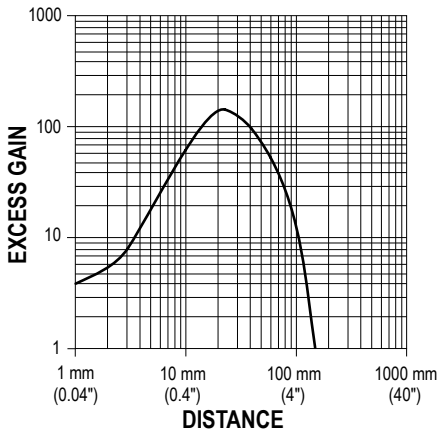
Target for Excess Gain Curves use a 90% Reflective White Card



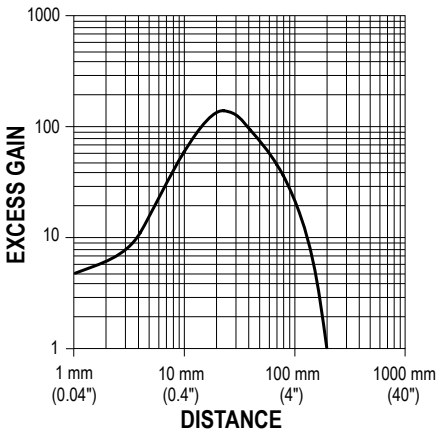
T18-2FF75
Emitter Image Size: 4.5 mm square at 37 mm and 4.0 mm square at 75 mm
18% Gray Test Card: Cutoff distance will be 98% of value shown
6% Black Test Card: Cutoff distance will be 92% of value shown



T18-2FF100
Emitter Image Size: 4.5 mm square at 50 mm and 4.5 mm square at 100 mm
18% Gray Test Card: Cutoff distance will be 95% of value shown
6% Black Test Card: Cutoff distance will be 90% of value shown



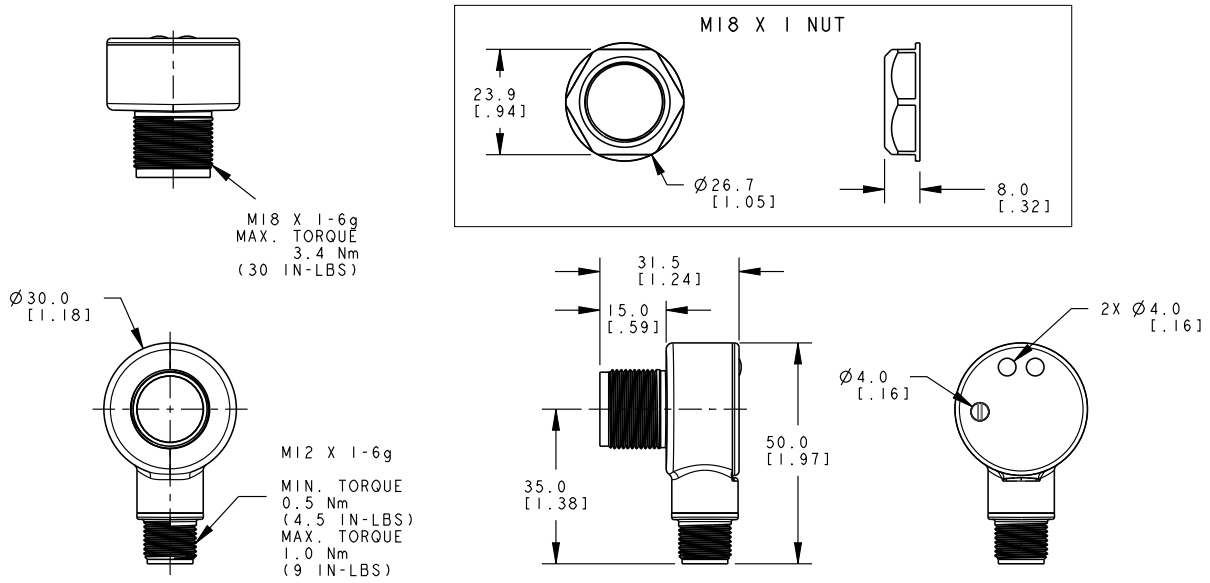
T18-2FF150
Emitter Image Size: 5 mm square at 75 mm and 8 mm square at 150 mm
18% Gray Test Card: Cutoff distance will be 90% of value shown
6% Black Test Card: Cutoff distance will be 70% of value shown



T18-2FF200
Emitter Image Size: 5 mm square at 100 mm and 8 mm square at 200 mm
18% Gray Test Card: Cutoff distance will be 85% of value shown
6% Black Test Card: Cutoff distance will be 60% of value shown

Dimensions

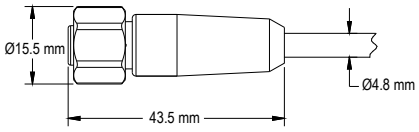
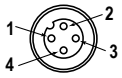
All measurements are listed in millimeters [inches], unless noted otherwise.

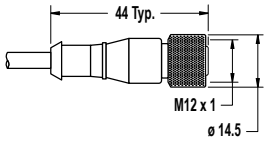
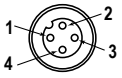
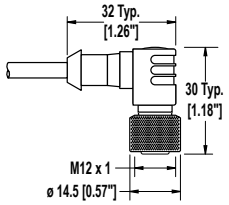


Accessories

Cordsets

All measurements are listed in millimeters, unless noted otherwise.

4-Pin Threaded M12/Euro-Style Cordsets—Washdown, Stainless Steel, Single Ended				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDC-WDSS-0406	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black
MQDC-WDSS-0415	5 m (16.4 ft)			
MQDC-WDSS-0430	9 m (29.5 ft)			

4-Pin Threaded M12/Euro-Style Cordsets—Single Ended				
Model	**Length**	**Style**	**Dimensions**	**Pinout (Female)**
MQDC-406	2 m (6.56 ft)	Straight		 1 = Brown 2 = White 3 = Blue 4 = Black
MQDC-415	5 m (16.4 ft)			
MQDC-430	9 m (29.5 ft)			
MQDC-450	15 m (49.2 ft)			
MQDC-406RA	2 m (6.56 ft)	Right-Angle		
MQDC-415RA	5 m (16.4 ft)			
MQDC-430RA	9 m (29.5 ft)			
MQDC-450RA	15 m (49.2 ft)			

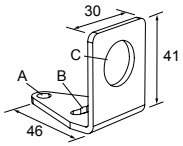
Apertures

Model	Units	Aperture Description	Product
AP18SCN	3	Kit includes round apertures of 0.5 mm (0.02 in), 1.0 mm (0.04 in), and 2.5 mm (0.10 in) diameter.	
AP18SRN	3	Kit includes rectangular apertures of 0.5 mm (0.02 in), 1.0 mm (0.04 in), and 2.5 mm (0.10 in) wide. Each kit also includes a thread-on housing, Teflon® FEP® lens, and o-ring.	
APG18S	1	Kit with glass lens to protect plastic sensor lens from chemical environments and weld splatter damage.	

Brackets

SMB18A

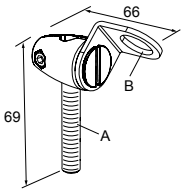
- Right-angle mounting bracket with a curved slot for versatile orientation
- 12-ga. stainless steel
- 18 mm sensor mounting hole
- Clearance for M4 (#8) hardware



Hole center spacing: A to B = 24.2
Hole size: A = ø 4.6, B = 17.0 × 4.6, C = ø 18.5

SMB18FA..

- Swivel bracket with tilt and pan movement for precision adjustment
- Easy sensor mounting to extruded rail T-slots
- Metric and inch size bolts available
- 18 mm sensor mounting hole

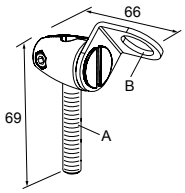


Hole size: B=ø 18.1

Model	Bolt Thread (A)
SMB18FA	3/8 - 16 × 2 in
SMB18FAM10	M10 - 1.5 × 50
SMB18FAM12	n/a; no bolt included. Mounts directly to 12 mm (½ in) rods

SMB18FA..-SS

- Swivel bracket with tilt and pan movement for precision adjustment
- Easy sensor mounting to extruded rail T-slots
- Stainless steel
- Metric and inch size bolts available
- 18 mm sensor mounting hole

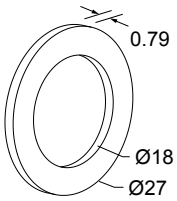


Hole size: B=ø 18.1

Model	Bolt Thread (A)
SMB18FA-SS	3/8 - 16 × 2 in
SMB18FAM10-SS	M10 - 1.5 × 50
SMB18FAM12-SS	n/a; no bolt included. Mounts directly to 12 mm (½ in) rods

ACC-T18-2-GSK-FDA-10 Gasket Kit

- FDA approved blue silicon
- 18 mm ID; 27 mm OD; 0.79 mm thick
- Quantity: 10

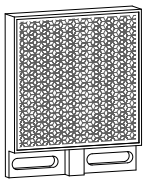


For additional brackets, check the current Banner catalog or visit www.bannerengineering.com. All measurements are listed in millimeters, unless noted otherwise.

Reflectors

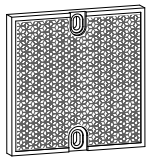
BRT-2X2

- Square, acrylic target
- Reflectivity factor: 1.0
- Max. temperature: +50 °C (+122 °F)
- Optional brackets are available
- Approximate size: 51 mm × 51 mm



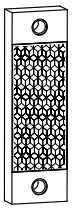
BRT-84X84A

- Square, acrylic target
- Reflectivity Factor: 2.0
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Approximate size: 84 mm × 84 mm



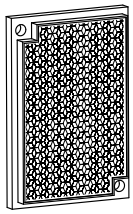
BRT-40X19A

- Rectangular, acrylic target
- Reflectivity Factor: 1.3
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Approximate size: 19 mm × 60 mm overall; 19 mm × 40 mm reflector



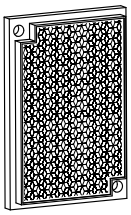
BRT-60X40C

- Rectangular, acrylic target
- Reflectivity Factor: 1.4
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Optional brackets are available
- Approximate size: 40 mm × 60 mm



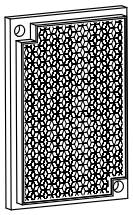
BRT-60X40IP69K

- Rectangular, acrylic target (color is amber)
- Reflectivity Factor: 0.7
- Temperature: –20 °C to +140 °C (–4 °F to +284 °F)
- Chemically resistant
- IP69K washdown rated
- Optional brackets are available
- Approximate size: 40 mm × 60 mm



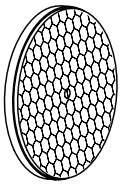
BRT-60X40AF

- Rectangular, acrylic target
- Reflectivity Factor: 1.4
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Anti-fogging coating for use around steam
- Optional brackets are available
- Approximate size: 40 mm × 60 mm



BRT-84

- Round, acrylic target
- Reflectivity Factor: 1.4
- Temperature: –20 °C to +60 °C (–4 °F to +140 °F)
- Optional brackets are available
- Size: 84 mm diameter
- Mounting Hole: 4.5 mm diameter



Retroreflective Tape

Model	Reflectivity Factor	Maximum Temperature	Size
BRT-THG-2-100	0.7	+60 °C (+140 °F)	50 mm (2 in) wide, 2.5 m (100 in) long

Banner Engineering Corp. Limited Warranty

Banner Engineering Corp. warrants its products to be free from defects in material and workmanship for one year following the date of shipment. Banner Engineering Corp. will repair or replace, free of charge, any product of its manufacture which, at the time it is returned to the factory, is found to have been defective during the warranty period. This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation of the Banner product.

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ER5018

SpeedSPEC www.sti.com ER5018

For full product information, visit www.sti.com. Use the SpeedSpec code or scan the QR Code for quick access to the specific web page.

Compact Rope Pull Emergency Stop Switch

- Compact size allows this switch to be used on smaller machines with a mounting width of 40 mm (1.57 in.) and covering rope spans up to 40 m (131 ft.)
- Tension indicator makes system setup and rop tension maintenance easy
- Contact arrangements of 2 N/C + 1 N/O or 3 N/C
- IP67 (NEMA 6) enclosure enables the ER5018 switch to withstand water washdown cleaning
- Heavy-duty housing—the die-cast housing and stainless steel eye nut makes the ER5018 suitable for demanding industrial applications
- Integral E-Stop—the optional E-stop provides emergency stopping at the extreme end of the installation
- Reset button—the blue reset button must be pushed in order to return to "machine run" condition following switch actuation by a pulled or slacked rope
- Vibration tolerant—the snap-acting switch contacts protect against nuisance tripping due to vibration
- Rubber bellows contain UV inhibitor making the switches suitable for outdoor applications
- A Rapid Delivery Product: Select models are available for shipment today or within 3 to 5 days

Conforms to IEC947-5-1, IEC947-5-5, EN418, UL508, BS5304
UL and C-UL listed, TUV certified

H

Specifications

Electrical	All Models
Contact Configurations:	2 N/C + 1 N/O, 3 N/C
Safety Contacts:	2 N/C, 3 N/C
Switching Ability	AC: 120 V–6 A, 240 V–3 A, Inductive DC: 24 V–2.5 A, Inductive
Auxiliary Contacts:	1 N/O
Max Switching Current/Volt/Amp:	240 V/720 VA
Minimum Current:	5 V 5 mA DC
Electrical Life:	1 x 10^6 minimum
Mechanical	
Mounting:	Any position
Mounting Hardware:	2 x M5 screws
Max Rope Span:	40 m (131 ft.)
Operation Force:	< 125 N (28 lb.)
Tensioning Force to Run Position:	130 N (23 lb.) typical
Case Material:	Die-cast aluminum alloy
Eye Nut Material:	Stainless Steel
Stainless Accessory Items:	304 Stainless Steel
Wiring Entry:	3 x M20 or 3 x 0.5 in. NPT
Weight:	675 g (23.8 oz.)
Color:	Yellow
Mechanical Life:	1 x 10^6 minimum
Environmental	
Protection:	IP67 (NEMA 6)
Operating Temperature:	-25 to 80°C (-13 to 176°F)
Cleaning:	Water washdown
Compliance	
Standards:	IEC947-5-1, IEC947-5-5, EN418, UL508, BS5304
Approvals/Listings:	CE marked for all applicable directives, UL and C-UL, TUV

Specifications are subject to change without notice.

Note: The safety contacts of the STI switches are described as normally closed (N/C)—i.e., with the rope properly tensioned and the machine able to be started.

Select models are available for Rapid Delivery.

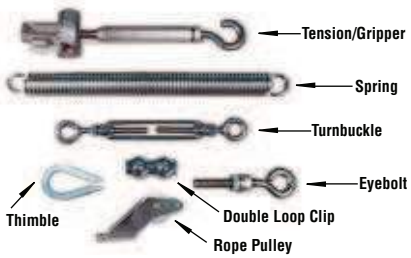
Visit this product on www.sti.com for details.

Operation

Blue Reset Knob
A blue reset button is provided to easily return the unit back to its machine-run position after actuation.

Emergency Push Button
The emergency push button may be installed or repositioned in the field. The ER5018 has two possible mounting positions for the emergency stop button.

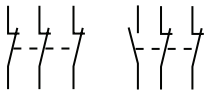
Installation Hardware Available



Installation Hardware
Individual hardware items may be purchased for specific installation requirements.

RK Rope Tension Kit
The RK Rope Tension Kit comes with all of the required hardware for most installations. A spring is required as shown in the installation example below.
For up to 50 m rope span, one rope end is terminated with a thimble, permanent clamp, and quick link attached.
For over 50 m rope span, 2 Tension/Gripper assemblies are supplied (no quick link.)

Contact Arrangements

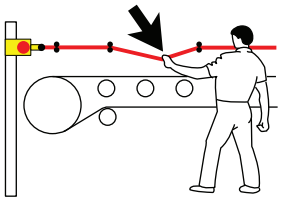


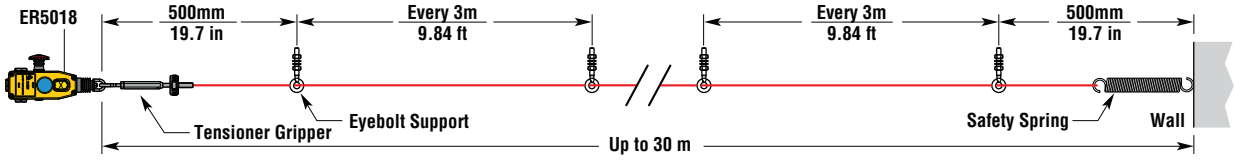
	0 mm / 0 in		3.5 / 0.14		14.5 / 0.57	17.0 / 0.67
2NC + 1NO Versions	Rope Slack		Tension Range			Rope Pulled
11/12						
21/22						
33/34						

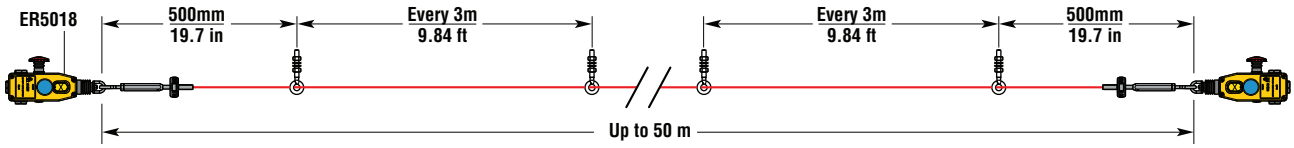
3NC Versions	Rope Slack	Tension Range	Rope Pulled
11/12			
21/22			
31/32			

□ Contact Open ■ Contact Closed

Mounting Specification



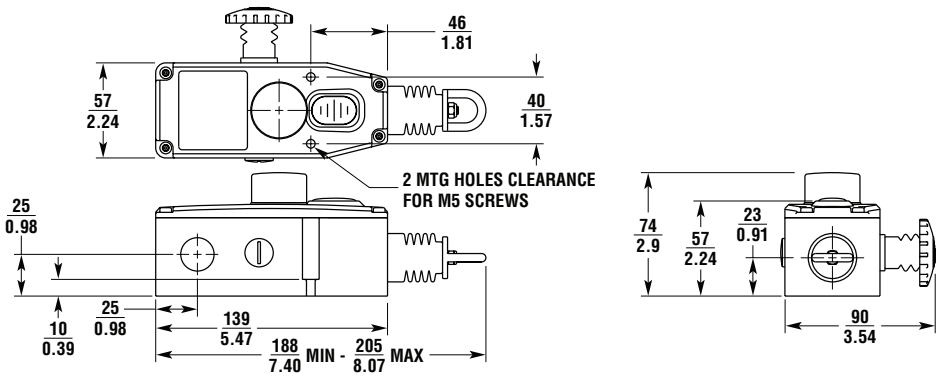




For a guide to installing, see “Proper Installation of Rope or Wire Pull Emergency Stop Devices” in The Expert Area Section of this catalog on page A78.

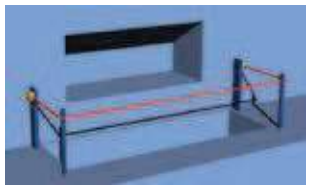
Dimensions

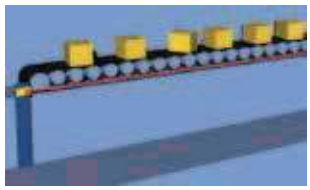
(mm/in.)



Applications

Typical applications are on conveyor systems and across rotating machinery, and around hazardous areas.





Ordering

Model	E-Stop	Contacts	Wiring Entry	Part No.
ER5018-021M	Not included	2 N/C + 1 N/O	3 x M20	44506-4010
ER5018-021N	Not included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-4020
ER5018-030M	Not included	3 N/C	3 x M20	44506-4030
ER5018-030N	Not included	3 N/C	3 x 1/2 in. NPT	44506-4040
ER5018-021ME	Included	2 N/C + 1 N/O	3 x M20	44506-4110
ER5018-021NE	Included	2 N/C + 1 N/O	3 x 1/2 in. NPT	44506-4120
ER5018-030ME	Included	3 N/C	3 x M20	44506-4130
ER5018-030NE	Included	3 N/C	3 x 1/2 in. NPT	44506-4140

Accessories					Part No.
Stainless Steel Rope Kits	Quick Link	Eye-bolts	Tension/ Gripper Assembly	Allen Wrench	
RK5, 5 m Kit	Yes	3	1	1	44506-2705
RK10, 10 m Kit	Yes	5	1	1	44506-2710
RK15, 15 m Kit	Yes	7	1	1	44506-2715
RK20, 20 m Kit	Yes	9	1	1	44506-2720
RK30, 30 m Kit	Yes	12	1	1	44506-2730
RK50, 50 m Kit	Yes	20	1	1	44506-2750
RK80, 80 m Kit	No	30	2	2	44506-2780
RK100, 100 m Kit	No	37	2	2	44506-2711
RK126, 126 m Kit	No	45	2	2	44505-2726
Rope Only					
R5M, 5 m Rope Only					44506-3705
R10M, 10 m Rope Only					44506-3710
R20M, 20 m Rope Only					44506-3720
R30M, 30 m Rope Only					44506-3730
R50M, 50 m Rope Only					44506-3750
R80M, 80 m Rope Only					44506-3780
R100M, 100 m Rope Only					44506-3711
R126M, 126 m Rope Only					44506-3726

Accessories	Part No.
SM06-SL400, Replacement Lid	44506-3700
SMO6-TK00, Tensioner Kit (Turnbuckle, 8 Rope Grips & 4 Thimbles)	44506-0700
SM06-TG00, Tensioner Gripper, Stainless Steel	44506-4700
SM06-EB10, Eye Bolt, Stainless Steel, 8 per pack	44506-4710
SM06-EB20, Eye Bolt, Galvanized	44506-0720
SM06-DL20, Double Loop Clip, Stainless Steel, 4 per pack	44506-4720
SM06-DL21, Double Loop Clip, Galvanized, 4 per pack	44506-4721
SM06-THSS, Thimble, Stainless Steel, 4 per pack	44506-4770
SM06-THGV, Thimble, Galvanized, 4 per pack	44506-4771
SM06-TB30, Turnbuckle, Stainless Steel	44506-4730
SM06-TB31, Turnbuckle, Galvanized	44506-4731
SM06-SP30, Spring, Galvanized	44506-0730
SM06-SP50, Spring, Stainless Steel	44506-4750
SM06-RPSS, Rope Pulley, Stainless Steel	44506-4780
SM06-ES60, E-Stop Mechanism	44506-4760

Select models are available for Rapid Delivery.

Visit this product on www.sti.com for details.

PART 3: POLYMER DOSING SYSTEM

OR-TEC BLEND 1500PD POLYMER DOSING SYSTEM

FRAME

1. The frame is constructed of 1/8" thick 304 stainless steel.

2. All supports, nuts, bolts, washers and clamps used in construction and installation are 304 stainless steel.

FLOW CONTROL VALVE

1. The dilution water inlet flow control valve is a King Instrument Co. acrylic block model with a manually adjustable flow 0-10gpm.

2. The post-dilution water inlet flow control valve is a King Instrument Co. acrylic block model with a manually adjustable flow 0-10gpm.

PRESSURE GAUGES

1. The gauges are manufactured by the Valley Gauge Corporation. They are glycerine filled.

2. The water pressure read is a 100 psi maximum pressure rating gauge.

3. The chemical pressure is read by a 100 psi maximum pressure rating gauge.

4. The body clamp and 1/4" NPT are all 316 stainless steel.

CHEMICAL SEAL

1. The 100 psi gauge is protected from direct contact with the chemical by a diaphragm type chemical seal.

2. The diaphragm housing, upper and lower, and diaphragm are constructed of 316 stainless steel.

3. The diaphragm is connected to the gauge by an armored, glycerine-filled, stainless steel capillary line.

TUBING

1. All tubing is schedule 80 PVC with a maximum pressure rating of 300 psi.

HOSE CONNECTIONS

1. Parker Hannifin A-LOK 316 stainless steel.

2. Banjo glass filled polypropylene cam operated couplings with EPT gaskets.

HOSE

1. Parker manufactured NSF-51 hose.
   A. The 1/2" O.D. hose has a maximum pressure rating of 90 psi.
   B. The 3/8" O.D. hose has a maximum pressure rating of 125 psi.

2. Nalgene 980 braided 5/8" ID vinyl tubing has a working pressure rating of 230 psi. An outer layer coating protects against weathering and ultraviolet radiation.

MIXING / RETENTION VESSEL

1. The vessel is an OR-TEC 750.

2. The caps on the retention vessel are Sch 80. PVC Clear PVC is used for the mixing cell wall.

3. To create mixing in the vessel schedule 80 pipe is configured at the inlet side of the vessel to impart a vortex motion in the fluid.

4. The vessel capacity is 1.4 gallons and is tested to 70 psi.

5. Post dilution will have a second smaller vessel that will have static mixers built in. A valving arrangement will allow operators to select the secondary water source if further make down is required.

CORMAIC (INJECTION NOZZLE / CHECK VALVE)

1. The *OR-TEC* Cormaic (injector) is a precisely machined PVC injection nozzle.

2. The ends have 1/4" threads to fit into the injection block.

METERING PUMP

1. The E Plus series diaphragm metering pump is manufactured by Pulsafeeder. Part # will be LPG5SA-PTS7-XXX

2. The pump is capable of pumping 96 gallons per day at 100 psi. The electromagnetic drive mechanism is connected to a diaphragm. This mechanism is pulsed by the control circuit. When the unit is de-energized, it returns the diaphragm and pulls more fluid into the pump head and repeats the cycle.

3. The flow rate is controlled manually with a percent stroke dial and a percent speed dial.

4. Parts that are in contact with the solution are constructed from glass filled Polypropylene, PVC, SAN, Hypalon, Viton, Teflon, 316 stainless steel, PVDF, Ceramic and Alloy C. These materials are corrosion resistant to most chemicals.

5. The pump can be controlled automatically via 4-20 mA signal. This signal can then be set at a ratio from 100% to 1%.

FLOW SWITCH

1. The Gems in-line flow switch is constructed from ryton.

2. Port connections are 1/2" NPT.

3. In the event of a dilution water flow below 1 gpm the flow switch will send a signal to shut off the metering pump.

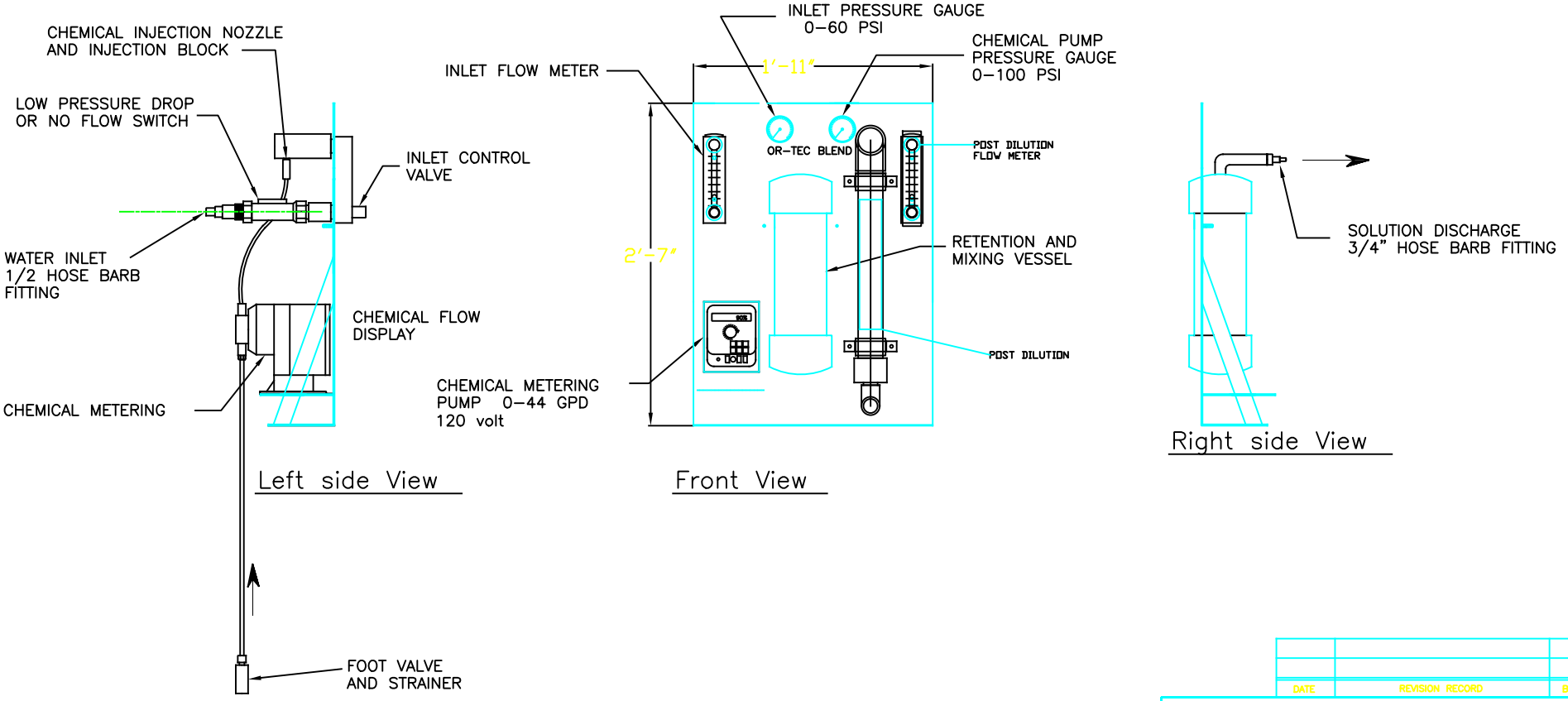
INJECTION BLOCK

1. A machined *OR-TEC* injection block is located after the flowmeter. This is where the chemical is first introduced to water.

2. It is constructed from PVC. Port connections are as follows:
   3/4" NPT inlet
   1/2" NPT outlet
   1/4" NPT chemical injection port
   1/4" NPT water pressure gauge connection

THE OR-TEC BLEND 1500PD is mounted, piped and wired on the belt press frame. Operation is controlled by the belt press control panel. In automatic mode the system water supply and polymer pump are turned on during the equipment start up sequence. During the automatic shutdown sequence the polymer pump turns off first and allows dilution water to flush out the system. The dilution water is then shut off automatically by closing a solenoid valve. Changes can be made to the polymer dosing by adjusting the pump stroke and/or speed on the front of the pump. Dilution water changes are effected by adjusting the dilution water or post dilution feed rates on the polymer dosing system.

In order to prevent any possible damage during transit or installation polymer dosing systems are normally delivered and fitted at the time the belt press is being started up by Or-Tec personnel.



DATE	REVISION RECORD	BY

AUTO–CAD FORMAT: ACFORMAT
MACHINING TOLERANCE UNLESS SPECIFIED
DECIMAL: .XX = .010 ±, .XXX = .005 ±, .XXXX = .0005 ±
FRACTIONAL: 1/32" = 1/64 ±, 1/16" = 1/32 ±, 1/8" = 1/16 ±
SURFACE 125
ANGLES ± 1°

SLUDGE DEWATERING & FLOTATION SPECIALISTS

OR–TEC, INC.

267 NORTHFIELD RD
BEDFORD, OHIO 44146
PHONE: 440–232–4224
www.or–tec.com

SCALE: NONE
APPROVED BY: P.Mgr. DATE
: P.Engr. DATE
DRAWN BY DKM
DATE: 3/97
REVISED

OR–TEC BLEND

DRAWING NUMBER
MASTER\1500z LAYOUT

7520 & 7530 Series - Acrylic Tube

Economical machined cast acrylic block construction makes these meters great for OEM use. Optional inlet metering valve available.

Description

Metering Tube Machined Cast Acrylic

Internal Components 316L Stainless Steel

Inlet/Outlet Fittings NPT, Horizontal

Inlet valve optional

Fitting Material

Standard: PVC (Brass for 2C block size)

Optional: 316L Stainless Steel, Brass

Elastomers

Standard: EPR

Optional: Buna N, Viton, and Kalrez®

Case and Covers Not applicable

Options

Alarm Not available

Certified Calibrations

Conform to ISA RP 16.6

Scales

Can be produced in any volumetric unit

Liquid Compatible

Gas Compatible

Performance

Capacities

7 GPH to 20 GPM – Water

2.6 SCFH to 60 SCFM – Air

Scale 50 mm, 75 mm, 100 mm, 127 mm, 250 mm

Direct reading

Accuracy

± 6% of Full Scale Flow, 50 mm scale

± 4% of Full Scale Flow, 75 mm scale

± 4% of Full Scale Flow, 100 mm scale

± 7% of Full Scale Flow, 6C-04, 6C-06

± 3% of Full Scale Flow, 127 mm scale

± 2% of Full Scale Flow, 250 mm scale

Turndown 10:1 to12.5:1 unless otherwise indicated

Repeatability

3%, 50 mm scale	4%, 6C-04, 6C-06
2%, 75 mm scale	2%, 127 mm scale
2%, 100 mm scale	1%, 250 mm scale

Max Temperature

Water – 130° F (54° C)

Air – 100° F (38° C)

Max Pressure

Water – 125 psig

Air – 100 psig

Ambient Temperature 33° F to 125° F (1° C to 52° C)

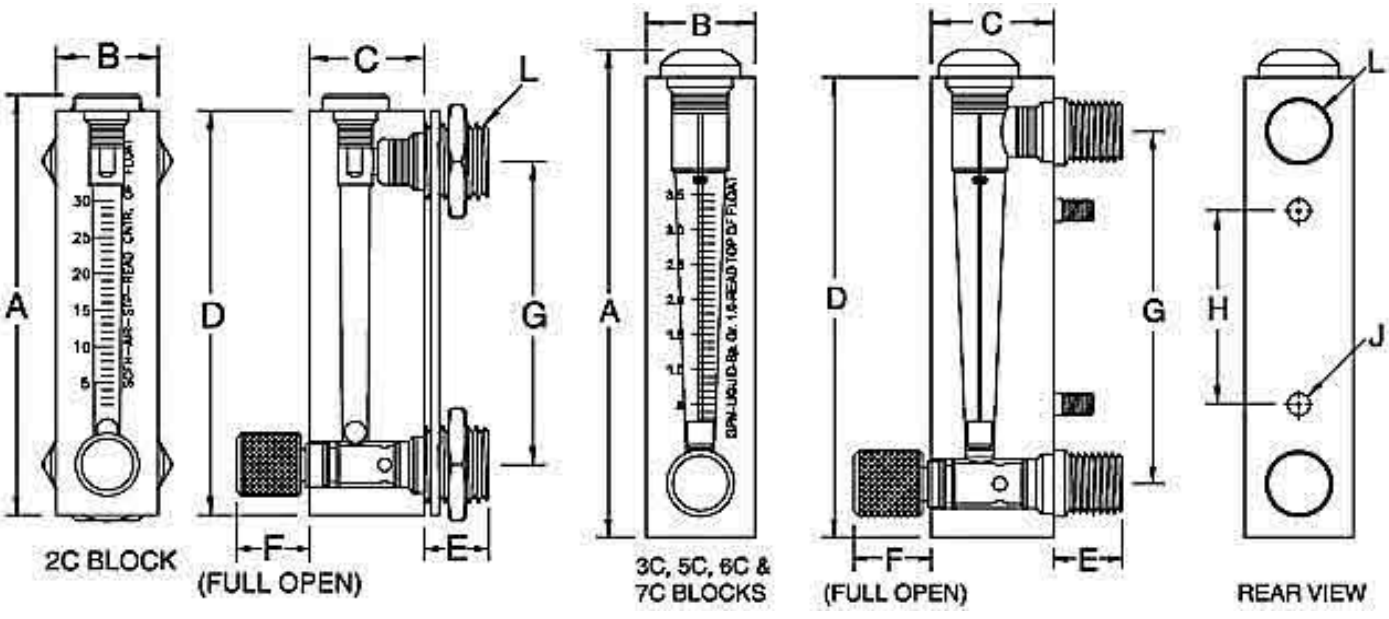
Materials Of Construction

Model	7520	7520	7530	7530
Block #	**2C**	**3C, 5C, 6C & 7C**	**2C**	**3C, 5C, 6C & 7C**
Meter Tube	Cast Acrylic	Cast Acrylic	Cast Acrylic	Cast Acrylic
Fittings	Brass*, 316L SS	PVC*, Brass, 316L SS	Brass*, 316LSS	PVC*, Brass*, 316L SS
O-Rings	EPR*, Buna-N, Viton®	EPR*, Buna-N, Viton®	EPR*, Buna-N, Viton®	EPR*, Buna-N, Viton®
Valve Assembly	Not Available	Not Available	Brass*, 316L SS	Brass*, 316L SS

*Denotes standard construction.

Specifications

Order Number	Flow Water	Order Number	Flow Air	Dimensions (Inches) A	B	C	D	E	F	G
Block #2C, 50mm (2" Inch) Scale										
–	–	2C-01	2.6 SCFH	4.125	1	1.25	4	0.5	1.125	3
–	–	2C-03	5 SCFH	4.125	1	1.25	4	0.5	1.125	3
–	–	2C-05	10 SCFH	4.125	1	1.25	4	0.5	1.125	3
–	–	2C-07	20 SCFH	4.125	1	1.25	4	0.5	1.125	3
2C-02	7 GPH	2C-09	30 SCFH	4.125	1	1.25	4	0.5	1.125	3
2C-04	12 GPH	2C-11	60 SCFH	4.125	1	1.25	4	0.5	1.125	3
2C-06	22 GPH	2C-13	100 SCFH	4.125	1	1.25	4	0.5	1.125	3
2C-08	44 GPH	2C-15	180 SCFH	4.125	1	1.25	4	0.5	1.125	3
2C-10	60 GPH	2C-17	4 SCFM	4.125	1	1.25	4	0.5	1.125	3
2C-12	75 GPH	–	–	4.125	1	1.25	4	0.5	1.125	3
Block #3C, 75mm (3" Inch) Scale										
3C-02	1 GPM	3C-01	4 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
3C-04	2 GPM	3C-03	8 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
3C-06	3.5 GPM	3C-05	15 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
3C-08	5 GPM	3C-07	25 SCFM	6.812	1.25	1.375	6.625	1	1.25	5
Block #5C, 127mm (5" Inch) Scale										
5C-10	10 GPH	5C-11	42 SCFH	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-12	20 GPH	5C-13	100 SCFH	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-14	40 GPH	5C-15	175 SCFH	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-02	1 GPM	5C-01	4 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-04	100 GPH	5C-03	6.8 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-06	2 GPM	5C-05	8.2 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
5C-08	5 GPM	5C-07	22 SCFM	8.375	1.25	1.375	8.25	1	1.25	6.437
Block #6C, 100mm (4" Inch) Scale										
6C-02	10 GPM	6C-01	40 SCFM	9.125	1.75	1.812	8.875	1.25	1.875	6.5
6C-04	15 GPM	6C-03	60 SCFM	9.125	1.75	1.812	8.875	1.25	1.875	6.5
6C-06	20 GPM	–	–	9.125	1.75	1.812	8.875	1.25	1.875	6.5
Block #7C, 250mm (10" Inch) Scale										
7C-02	2 GPM	7C-01	8 SCFM	14.5	1.75	1.812	14.25	0.75	1.875	12.25
7C-04	3.5 GPM	7C-03	14.4 SCFM	14.5	1.75	1.812	14.25	0.75	1.875	12.25
7C-06	5 GPM	7C-05	20 SCFM	14.5	1.75	1.812	14.25	0.75	1.875	12.25
7C-08	10 GPM	7C-07	42 SCFM	14.5	1.75	1.812	14.25	0.75	1.875	12.25



Connections & Mounting

Block Number	Connection Size	Centerline H	Thread J	Diameter L
2C	.25" FNPT	–	–	0.625
3C	.50" MNPT x .25"FNPT	3	.25 - 20	1
5C	.50" MNPT x .25"FNPT	3.937	.25 - 20	1
6C	1" MNPT	4	.25 - 20	1.375
7C	.50" FNPT	8.75	.375 - 24	1.25

Ordering:

Use the following guide to determine the specific product number you require.

7	5												

Meter Series	Fitting Material	O-Ring Material	Valve Material	Order Number
7520 No valve	Brass - 1	EPR - 1	Brass - 1	See Specifications
7530 With valve	PVC - 2	Buna-N - 2	316L SS - 2	Table
	316L SS - 3	Viton® - 3	Without Valve - 0	

Example: 7520 - 1 - 1 - 0 - 5C06

King Instrument Company

E-mail: sales@kinginstrumentco.com • **Phone: (714) 891-0008 • Fax: (714) 891-0023**

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PULSAtron® Series E PLUS

Electronic Metering Pumps

PULSAFEEDER®
A Unit of IDEX Corporation

Key Features

- ***Automatic Control,*** available with 4-20 mADC direct or external pacing, with stop function.
- ***Manual Control*** by on-line adjustable stroke rate and stroke length.
- ***Agency approved*** for demanding ***OUTDOOR*** and indoor applications.
- ***Auto-Off-Manual*** switch.
- ***Highly Reliable*** timing circuit.
- ***Circuit Protection*** against voltage and current upsets.
- ***Panel Mounted Fuse.***
- ***Solenoid Protection*** by thermal overload with auto-reset.
- ***Water Resistant,*** for outdoor and indoor applications.
- ***Indicator Lights,*** panel mounted.
- ***Guided Ball Check Valve Systems,*** to reduce back flow and enhance outstanding priming characteristics.
- ***Safe & Easy Priming*** with durable leak-free **bleed valve assembly** (standard).

Complete Economical Selection

Nineteen distinct models are available, having pressure capabilities to 300 PSIG @ 3 GPD, and flow capacities to 504 GPD @ 20PSIG, with a turndown ratio of 100:1. Metering performance is reproducible to within ± 2% of maximum capacity.

Please refer to the reverse side for Series E PLUS specifications.

Operating Benefits

Reliable metering performance. Our guided check valves, with their state-of-the-art seat and ball designs, provide precise seating, and excellent priming and suction lift characteristics. Our timing circuit is highly reliable and, by design, virtually unaffected by temperature, EMI and other electrical disturbances.

Rated "hot" for continuous duty. Series E PLUS pumps continue to meet their specifications for pressure and capacity even during extended use. That's because of our high quality solenoid and special enclosure that effectively dissipates heat.

High viscosity capability. A straight flow path and ample clearance between the diaphragm and head enable standard PULSAtron pumps to handle viscous chemicals up to a viscosity of 3000 CPS. For higher vicosity applications, larger, spring-loaded connections are available.

Leak-free, sealless, liquid end. Our diaphragms are of superior construction—PTFE-faced, bonded to a composite of Hypalon and fabric layers, and reinforced with a metal insert for optimum flexibility and durability.

For additional information about PULSAtron's full-featured Series MP refer to Technical Sheet No. EMP-027, about the mid-range Series E, Series D & Series A PLUS refer to Technical Sheet No. EMP-022, EMP-023 & EMP-025. For information about the economical Series C PLUS & Series C, refer to Technical Sheet No. EMP-026 & EMP-024.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE.

IDEX CORPORATION

System Compatibility

A wide variety of chemicals can be pumped.
Liquid end materials include glass-filled polypropylene (GFPPL), PVC, styrene-acrylonitrile (SAN), Polyvinylidene Fluoride (PVDF), PTFE, Hypalon, Viton, ceramic, alloys and 316SS.

Immediate installation and start-up.
Included as standard accessories with all models are an injection/back pressure valve assembly and a foot valve/ strainer assembly*, including discharge and suction tubing (*not avail. with high viscosity connections for >3000 CPS).

Safe and easy priming and valve maintenance.
Included as a standard accessory is a bleed valve assembly, including return tubing (available only on those models with tubing connections and ≤ 240 GPD).

Quick and economical liquid end maintenance.
Available for every model is a unique KOPkit®, a convenient, economically priced, package containing new cartridge check valves and other important spare parts.

technology innovation diversity excellence

PULSAtron Series E PLUS Specifications

Pressure and Flow Rate Capacity

MODEL		LPK2	LPB2	LPA2	LPD3	LPB3	LPA3	LPK3	LPF4	LPD4	LPB4	LPH4	LPG4	LPE4	LPK5	LPH5	LPH6	LPK7	LPH7	LPH8
Capacity	GPH	0.13	0.21	0.25	0.50	0.50	0.50	0.60	0.85	0.90	1.00	1.70	1.75	1.85	2.50	3.15	5.00	8.00	10.00	25.00
nominal	GPD	3	5	6	12	12	12	14	20	22	24	41	42	44	60	76	120	192	240	600
(max.)	LPH	0.5	0.8	0.9	1.9	1.9	1.9	2.3	3.2	3.4	3.8	6.4	6.6	7.0	9.5	11.9	18.9	30.3	37.9	94.6
Pressure	PSIG	300	250	150	250	150	100	100	250	150	100	250	150	100	150	150	100	50	35	30
(max.)	BAR	21	17	10	17	10	7	7	17	10	7	17	10	7	10	10	7	3.3	2.4	2
Connections:	Tubing	1/4" ID X 3/8" OD 3/8" ID X 1/2" OD 3/16" ID X 5/16" OD													3/8" ID X 1/2" OD 1/2" ID x 3/4" OD (LPH8 ONLY)					
	Piping	1/4" FNPT													1/4" FNPT 1/2" FNPT					
Reproducibility at max. capacity		+/- 2%																		
Viscosity Max CPS		For viscosity up to 3000 CPS, select connection size 3, 4, B or C with 316SS ball material. Flow rate will determine connection/ball size. Greater than 3000 CPS require spring loaded ball checks. See Selection Guide for proper connection.																		
Stroke Frequency Max SPM		125																		
Stroke Frequency Turn-Down Ratio		10:1																		
Stroke Length Turn-Down Ratio		10:1																		
Power Input		115 VAC/50-60 HZ/1 ph 230 VAC/50-60 HZ/1 ph																		
Average Current Draw @ 115 VAC: Amps @ 230 VAC: Amps		1.0 0.5																		
Peak Input Power Watts		300																		
Average Input Power @ max SPM: Watts		130																		

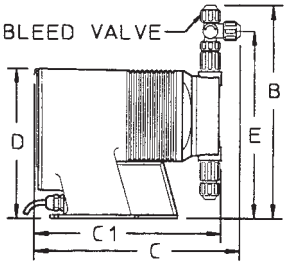
Important: Series E PLUS - 19 model selections. Digit 1 and 2 (LP) signify product class, digit 3 and 4 signify pressure/flow. For full model selection information refer to Price Schedule EMP-PS LP.

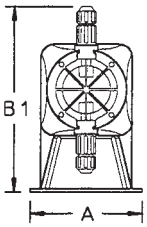
Liquid End Materials

Series	Pump Head	Diaphragm	Check Valves		Fittings	Bleed Valve	Injection Valve Assembly Foot Valve Assembly	Tubing
			Seats/O-Rings	Balls				
E PLUS	GFPPL PVC SAN PVDF 316 SS	PTFE-faced Hypalon-backed	PTFE, Hypalon, Viton	Ceramic, PTFE, 316SS, Alloy C	GFPPL PVC PVDF	Same as fitting and check valve selected, except 316SS	Same as fitting and check valve selected	Clear PVC White PE

Important: Material Code— GFPPL = Glass-filled Polypropylene, PVC = Polyvinyl Chloride, SAN = Styrene-Acrylonitrile, PE = Polyethylene, PVDF = Polyvinylidene Fluoride. Hypalon and Viton are registered trademarks of E.I. DuPont Company. PVC wetted end recommended for sodium hypochlorite.

Dimensions





Series E Plus Dimensions (inches)																	
Model No.	A	B	B1	C	C1	D	E	Shipping Weight	Model No.	A	B	B1	C	C1	D	E	Shipping Weight
LPA2	5.4	10.3	-	10.8	-	7.5	8.9	13	LPH4	6.2	10.9	-	11.2	-	8.2	9.5	21
LPA3	5.4	10.6	-	10.7	-	7.5	9.2	13	LPH5	6.2	11.3	-	11.2	-	8.2	9.9	21
LPB2	5.4	10.3	-	10.8	-	7.5	8.9	13	LPH6	6.2	11.3	-	11.9	-	8.2	9.9	21
LPB3	5.4	10.6	-	10.7	-	7.5	9.2	13	LPH7	6.1	11.7	-	11.9	-	8.2	10.3	21
LPB4	5.4	10.6	-	10.7	-	7.5	9.2	13	LPH8*	6.1	-	10.9	-	11.3	8.2	-	26
LPD3	5.4	10.6	-	11.2	-	7.5	9.2	15	LPK2	5.4	10.3	-	10.8	-	7.5	8.9	13
LPD4	5.4	10.6	-	11.2	-	7.5	9.2	15	LPK3	5.4	10.6	-	10.7	-	7.5	9.2	13
LPE4	5.4	10.6	-	11.2	-	7.5	9.2	15	LPK5	5.4	10.9	-	11.7	-	7.5	9.5	18
LPF4	5.4	10.6	-	11.7	-	7.5	9.2	18	LPK7	6.1	11.7	-	11.2	-	8.2	10.3	21
LPG4	5.4	10.6	-	11.7	-	7.5	9.2	18									

NOTE: Inches X 2.54 = cm
* the LPH8 is designed without a bleed valve available.

An ISO Certified Company

PULSAFEEDER®
A Unit of IDEX Corporation

IDEX CORPORATION

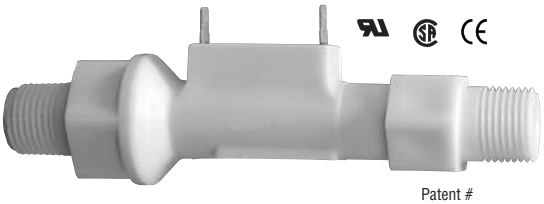
Standard Product Operations
27101 Airport Road • Punta Gorda, Florida 33982
TEL (941) 575-3800 • TEL 800-333-6677
FAX (941) 575-4085 • FAX 800-456-4085
spotech@pulsa.com • **www.pulsa.com**

Brochure No. EMP-021
Printed in the USA 04/04

FS-150 Series – Straight Flow Path with Low Pressure Drop

Flow Rate Settings: Liquids: 0.5 GPM to 5 GPM
Port Size: 1/2˝ NPT
Primary Construction Material: Polypropylene
Setting Type: Fixed

These slim, inline switches reduce pressure drop to a minimum. They incorporate a unique, dual-diameter, internal bore and piston configuration to minimize flow constriction. Liquids are able to smoothly pass around the piston and flow through the switch with little pressure loss to the down stream line.



Patent # 4.996.396

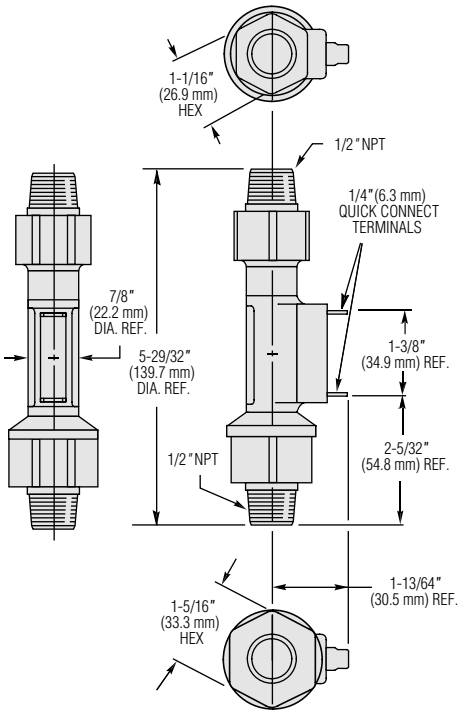
U.L. RECOGNIZED — FILE NO. E31926
CSA Listed — File No. LR30200

Specifications

Wetted Materials	
Housing	Polypropylene, Hydrolytically Stable, Glass Reinforced
Piston	Ryton®-R4, 316 Stainless Steel
O-Ring	Viton®
Spring	316 Stainless Steel
Operating Pressure, Maximum	200 PSIG @+70°F to +150°F (+21.1°C to 65.5°C) 150 PSIG @+150°F to +212°F (+65.5°C to +100°C)
Operating Temperature	0°F to 212°F (-17.8°C to +100°C)
Set Point Accuracy	±15%
Set Point Differential	20% Maximum
Switch*	SPST, 20 VA
Inlet/Outlet Ports	1/2˝ NPT Male
Electrical Termination	1/4˝ Male Quick Connect Terminals (2)

*See "Electrical Data" on Page X-5 for more information.

Dimensions



Note: Cable output available. Please consult factory.

How To Order – Standard Models

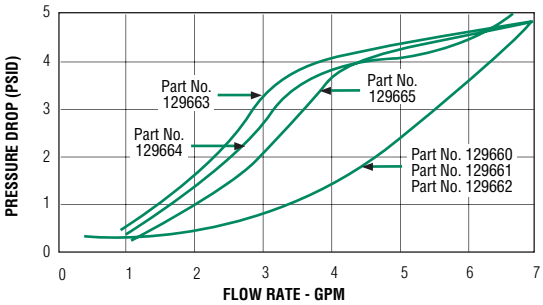
Specify Part Number based on flow setting and switch operation.

Flow Settings GPM	Part Numbers
	Normally Open @ No Flow
0.5	**129660** ⚡
1.0	**129661** ⚡
2.0	**129662** ⚡
3.0	**129663** ⚡
4.0	**129664**
5.0	**129665**

Notes:
1. Flow settings are calibrated using water @ +70°F on increasing flow, with units in a horizontal position (terminals up).
2. Care should be taken by specifiers to ensure fluid compatibility with the above listed wetted materials.
3. Use of 150 micron filtration is recommended.

⚡ – Stock Items.

Pressure Drop - Typical



Tests conducted with units in a horizontal position with water at +70°F (21°C). Data will vary slightly for vertically mounted units.

Bourdon Tube Pressure Gauges
Stainless Steel Series
Model 232.50/233.50, without/with Liquid Filling

Applications

- With liquid filled case for applications with high dynamic pressure pulsations or vibrations
- Suitable for corrosive environments and gaseous or liquid media that will not obstruct the pressure system
- Process industry: chemical/petro-chemical, power stations, mining, on- and offshore, environmental technology, mechanical engineering and plant construction

Special Features

- Excellent load-cycle stability and shock resistance
- All stainless steel construction
- Approval German Lloyd and Gosstandart
- Scale ranges up to 0 … 1600 bar

Bourdon Tube Pressure Gauge Model 232.50

Description

Design
EN 837-1

Nominal size
63, 100 and 160 mm

Accuracy class
63 mm: 1.6
100, 160 mm: 1.0

Scale ranges
63 mm: 0 ... 1 to 0 ... 1000 bar
100 mm: 0 ... 0.6 to 0 ... 1000 bar
160 mm: 0 ... 0.6 to 0 ... 1600 bar
or other equivalent units of pressure or vacuum

Working pressure

63 mm:	Steady:	¾ of full scale value
	Fluctuating:	⅔ of full scale value
	Short time:	full scale value
100, 160 mm:	Steady:	full scale value
	Fluctuating:	0.9 x full scale value
	Short time:	1.3 x full scale value

Operating Temperature
Ambient: -40 ... +60 °C
Medium: +200 °C maximum without liquid filling
+100 °C maximum with liquid filling

Temperature effect
When temperature of the pressure element deviates from reference temperature (+20 °C):
max. ±0.4 %/10 K of true scale value

Ingress protection
IP 65 per EN 60 529 / IEC 529

Stainless steel series model 232.30 see data sheet PM 02.04

WIKA
Part of your business

Standard features

Pressure connection
Material: stainless steel
Lower mount (LM) or lower back mount (LBM)
63 mm: G ¼ B (male), 14 mm flats
100, 160 mm: G ½ B (male), 22 mm flats

Pressure element
Material: stainless steel
< 100 bar: C-type
≥ 100 bar: helical type

Movement
Stainless steel

Dial
White aluminium with black lettering,
63 mm with pointer stop pin

Pointer
Black aluminium

Case
Natural finish stainless steel, with pressure relief in case top (63 mm) or in case back (100 and 160 mm),
ranges ≤ 10 bar with compensating valve to vent case

Window: Laminated safety glass

Bezel ring: Cam ring (bayonet type), natural finish stainl. steel

Liquid filling (for model 233.50): Glycerine 99.7 %

Special versions

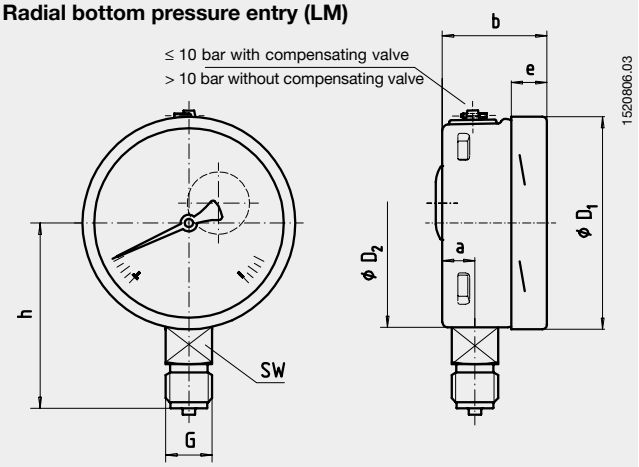
Ammonia gauges (100 and 160 mm)
Scale in °C for refrigerant R 717 (NH_3),
Pressure ranges: -1 ... 0 ... 15 bar or -1 ... 0 ... 26 bar

Optional extras

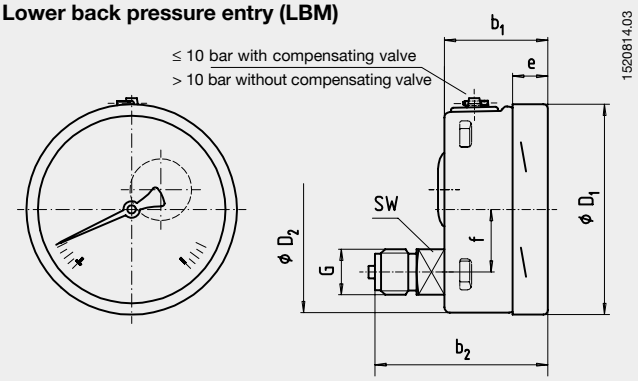
- Other pressure connection
- Monel pressure system (model 26X.50)
- 3-hole surface or panel mounting flange, stainless steel
- 3-hole panel mounting flange, stainless steel, polished
- Triangular bezel, stainless steel, polished, with clamp
- Alarm contacts (see data sheet AE 08.01)
- Transmitter (model 232.30 with combined transmitter model 89X.34, see data sheet PM 02.04 and AE 08.02)

Standard version

Radial bottom pressure entry (LM)



Lower back pressure entry (LBM)



Dimensions in mm

NS	Dimensions in mm											Weight in kg	
	a	b	b_1	b_2	D_1	D_2	e	f	G	h ± 1	SW	Mod. 232.50	Mod. 233.50
63	9,5	33	33	57	63	62	11.5	- 1)	G ¼ B	54	14	0.16	0.20
100	15.5	49.5	49.5	83	101	99	17.5	30	G ½ B	87	22	0.60	0.90
160	15.5	49.5 3)	49.5 2)	83 2)	161	159	17.5	50	G ½ B	118	22	1.10	2.00

Standard pressure entry with parallel thread and sealing to EN 837-1 / 7.3
1) Centre back pressure entry (CBM)
2) Plus 16 mm with pressure ranges ≥ 100 bar
3) Plus 16 mm with pressure range 1600 bar

Ordering information
Pressure gauge model / Nominal size / Scale range / Size and location of connection / Optional extras required

Modifications may take place and materials specified may be replaced by others without prior notice.
Specifications and dimensions given in this leaflet represent the state of engineering at the time of printing.

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www.wika.de

9019723 02/2003 GB

PART 4:
WASHWATER PUMP

1. Grundfos CR10-06 high pressure pump to deliver 52 gpm @ 100 PSI.
2. Pump is coupled with a 5 HP, 3 Phase, 230/460 volt/60 hertz/ TEFC motor at a maximum of 3,500 rpm..
3. The pump is a vertical, multi-stage, inline centrifugal pump suitable for continuous commercial duty.
4. The pump impellers, intermediate chambers and shaft are fabricated from stainless steel.
5. Top and bottom housings are cast iron.
6. The pump is water lubricated and provided with a tungsten carbide faced mechanical shaft seal.
7. Pump is mounted separate from the belt press. To be piped and wired by other in the sludge press room.

Company name:
Created by:
Phone:

Date: 10/18/2016

Position	Count	Description
	1	**CR 10-6 A-GJ-A-E-HQQE**

Product No.: 96523174
Vertical, non-self-priming, multistage, in-line, centrifugal pump for installation in pipe systems and mounting on a foundation.

The pump has the following characteristics:
- Impellers and intermediate chambers are made of Stainless steel, DIN W.-Nr. 1.4301.
- Pump head and base are made of Cast iron.
- The shaft seal has assembly length according to EN 12756.
- Power transmission is via cast iron split coupling.
- Pipework connection is via ANSI flanges.

The motor is a 3-phase AC motor.

Liquid:

Pumped liquid:	Water
Liquid temperature range:	-4 .. 248 °F
Liquid temp:	68 °F
Density:	62.29 lb/ft³

Technical:

Speed for pump data:	3461 rpm
Actual calculated flow:	52.2 US gpm
Resulting head of the pump:	231.1 ft
Primary shaft seal:	HQQE
Approvals on nameplate:	ANSI/NSF61
Curve tolerance:	ISO9906:2012 3B

Materials:

Pump housing:	Cast iron EN-JL1030 ASTM A48-30 B
Impeller:	Stainless steel DIN W.-Nr. 1.4301 AISI 304

Installation:

Maximum ambient temperature:	140 °F
Max pressure at stated temperature:	232 psi / 250 °F 232 psi / -4 °F
Flange standard:	ANSI
Pipe connection:	2"
Pressure stage:	Class 250
Flange size for motor:	182TC

GRUNDFOS

Company name:
Created by:
Phone:

Date: 10/18/2016

Position	Count	Description

Electrical data:

Motor type:	112CA
Rated power - P2:	5.5 HP
Power (P2) required by pump:	5 HP
Main frequency:	60 Hz
Rated voltage:	3 x 208-230YY/460Y V
Service factor:	1,15
Rated current:	14,1-13,1/7,29 A
Starting current:	1000-1470 %
Cos phi - power factor:	0,89-0,86
Rated speed:	3525-3540 rpm
Motor efficiency at 3/4 load:	88.6 %
Motor efficiency at 1/2 load:	85.2 %
Number of poles:	2
Enclosure class (IEC 34-5):	55 Dust/Jetting
Insulation class (IEC 85):	F

Others:

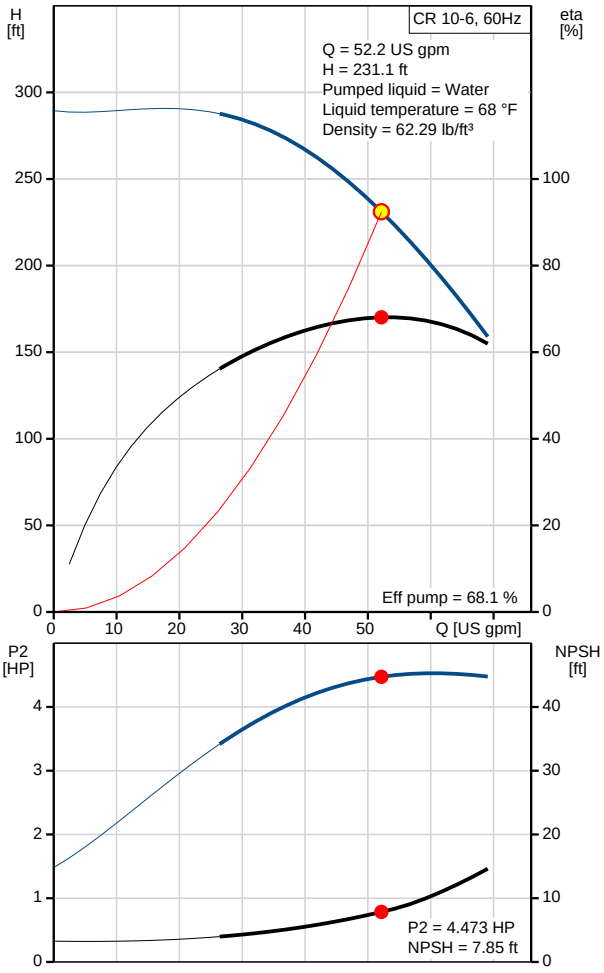
Net weight:	183 lb
Gross weight:	198 lb
Shipping volume:	4.94 ft^3

GRUNDFOS

Company name:
Created by:
Phone:

Date: 10/18/2016

Description	Value
General information:	
Product name:	CR 10-6 A-GJ-A-E-HQQE
Product No.:	96523174
EAN:	5700396899459
Price:	On request
Technical:	
Speed for pump data:	3461 rpm
Actual calculated flow:	52.2 US gpm
Resulting head of the pump:	231.1 ft
Head max:	289.4 ft
Impellers:	06
Primary shaft seal:	HQQE
Approvals on nameplate:	ANSI/NSF61
Curve tolerance:	ISO9906:2012 3B
Stages:	6
Pump version:	A
Model:	A
Cooling:	TEFC
Materials:	
Pump housing:	Cast iron
	EN-JL1030
	ASTM A48-30 B
Impeller:	Stainless steel
	DIN W.-Nr. 1.4301
	AISI 304
Material code:	A
Code for rubber:	E
Installation:	
Maximum ambient temperature:	140 °F
Max pressure at stated temperature:	232 psi / 250 °F
	232 psi / -4 °F
Flange standard:	ANSI
Connect code:	GJ
Pipe connection:	2"
Pressure stage:	Class 250
Flange size for motor:	182TC
Liquid:	
Pumped liquid:	Water
Liquid temperature range:	-4 .. 248 °F
Liquid temp:	68 °F
Density:	62.29 lb/ft³
Electrical data:	
Motor type:	112CA
Rated power - P2:	5.5 HP
Power (P2) required by pump:	5 HP
Main frequency:	60 Hz
Rated voltage:	3 x 208-230YY/460Y V
Service factor:	1,15
Rated current:	14,1-13,1/7,29 A
Starting current:	1000-1470 %
Cos phi - power factor:	0,89-0,86
Rated speed:	3525-3540 rpm
Motor efficiency at 3/4 load:	88.6 %
Motor efficiency at 1/2 load:	85.2 %



Company name:
Created by:
Phone:

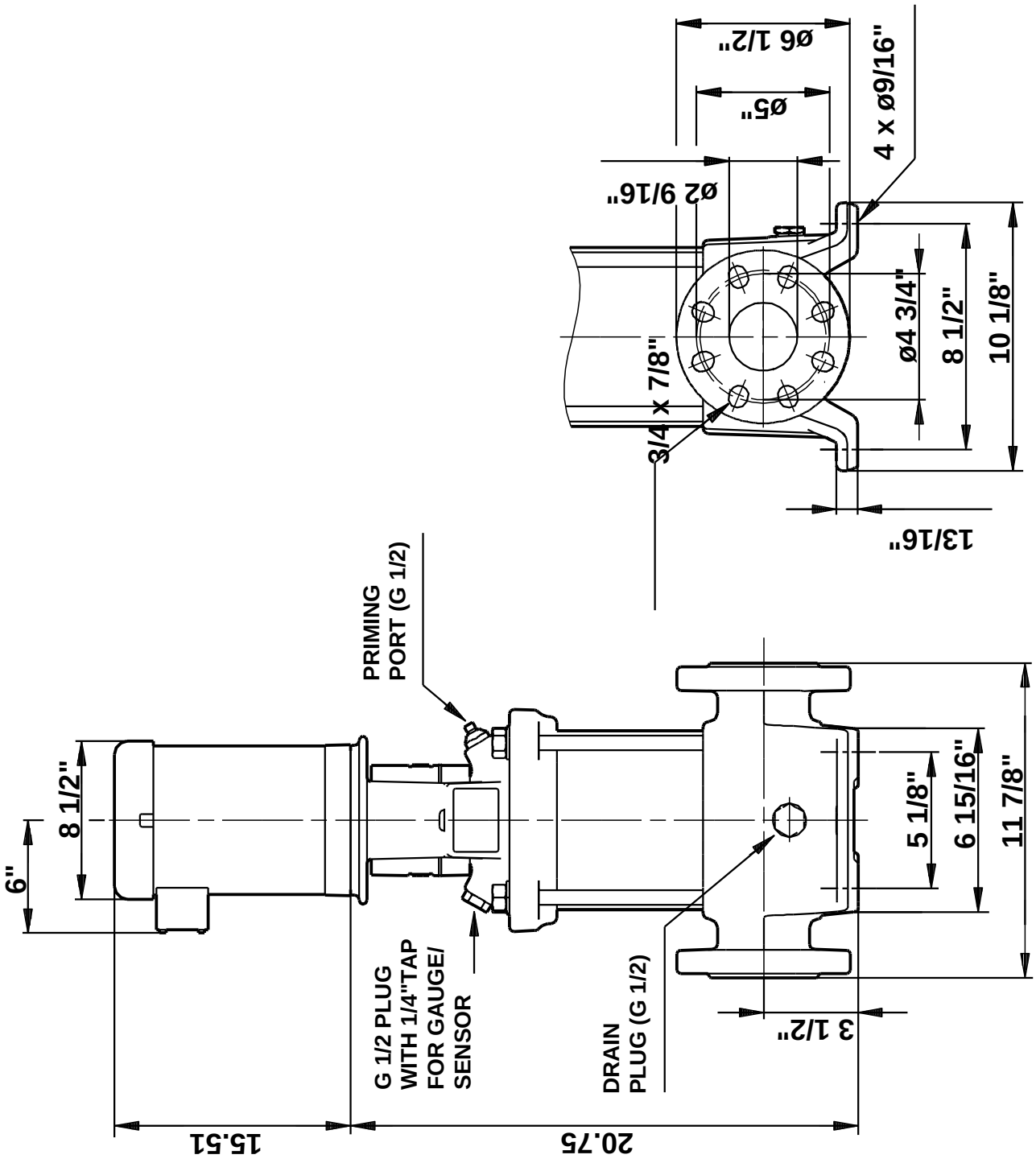
Date: 10/18/2016

Description	Value
Number of poles:	2
Enclosure class (IEC 34-5):	55 Dust/Jetting
Insulation class (IEC 85):	F
Motor protection:	PTC
Motor Number:	85904389
Others:	
Net weight:	183 lb
Gross weight:	198 lb
Shipping volume:	4.94 ft³

Company name:
Created by:
Phone:

Date: 10/18/2016

96523174 CR 10-6 60 Hz



Note! All units are in [mm] unless otherwise stated.
Disclaimer: This simplified dimensional drawing does not show all details.

PART 5:
SLUDGE PUMP

Pump for Thin Sludge

To be a block construction progressing cavity pump, oil filled pin joints with protective seal and with the mechanical seal so positioned that it is fully in the product flow within the suction housing. The pump will be mounted on a rectangular baseplate and driven by a geared motor.

Application Details

Pumped medium:	municipal thin sludge
Solid content:	approx. 1 to 5 % DS
Operating temperature:	50 – 86 °F
Suction:	Flooded -28'of water suction lift capacity
Capacity:	2160-10,800 gph
Pressure (max.):	30 psi
Speed:	60 - 330 rpm
Rubbing Velocity:	1.2 – 5.8 ft/s (max 4 ft/s)
Required Power:	0.8-3.8 at drive shaft
Motor Horsepower:	7.5 hp
Installation area:	inside building, dry environment
Manufacturer:	**NETZSCH**
Type:	**NM063BY01L07V**
Suction connection:	6-inch, 125lb ANSI Flange
Discharge connection:	4-inch, 125lb ANSI Flange

Materials:

Cast components:	Cast iron GG 25
Shaft:	Stainless steel
Connecting rod:	Stainless steel
Rotor:	Chrome Plated Alloy Steel
Stator:	Buna-N , with integrated gaskets
Joint seals:	SM Pin Joint
Shaft seal:	Single mechanical seal with silicon carbides faces
Baseplate:	Rectangular steel channel
Corrosion Protection:	Manufacturer's standard

NETZSCH Pumps North America, LLC
Exton, PA. 19341

Technical Pump Quotation

Check us out

NEMO® Model
NM063BY01L07V.1

Quote:	
Date:	
Project:	

Product:		***Content***	***nominal***	***minimum***	***maximum***
Name / Composition			Thin Sludge		
Product temperature	assumed	°F		60	80
Specific gravity	assumed		1.0		
Particle size	assumed	mm			12
pH value	assumed			5	8
Solids content (w/w)	assumed	%TS		2	3
Dynamic viscosity	assumed	CPS		1	100
Abrasiveness	assumed		Low		

"Materials of construction are only recommended based on the information provided. Customer needs to verify materials will be compatible with the process fluid or application."

Application details:		***Content***		***minimum***	***maximum***
Flow rate (Q)	approx.	GPM		36	180
Differential pressure		PSI		20	20
Suction pressure	assumed	PSI		Flooded	Flooded
Discharge pressure	approx.	PSI		20	20
Pump operating speed	approx.	RPM		70	350
Sliding velocity	approx.	ft./s		1.2	5.8
Frequency	approx.	Hz		12	60
Power required at drive shaft	approx.	HP		0.8	3.8
Running torque	approx.	ft./lbs.		57.5	57.5
Starting torque	approx.	ft./lbs.		114.7	114.7

Assembly specification	Installation:	Horizontal

General operating conditions	
Installation area	Inside
Ambient Temperature	Approx. 20°C / 70 F
Humidity	up to 75%
Application type	Continuous operation
Operating hours per day	8
Service voltage	3ph, 60hz, 230/460V

Painting	Coating system	NIL System I RAL 7031 NETZSCH gray

Operating and Maintenance Instructions
Standard documentation in accordance with the 98/37/EG Machinery Directive.
The Operational Manual is provided in English and additional Safety instructions in Spanish
Request the Operating and Maintenance at https://www.netzschusa.com/distributors/OM.html

Rev - 5/4/2018

Pump: NM063BY01L07V.1

Picture is for reference only and may not be exact model specified

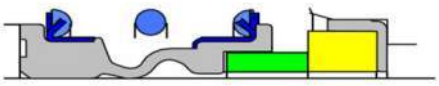
Characteristics and benefits of the FSIP® Ready pump:
Reliable and sophisticated construction
Features large FSIP servicing cover (window)
Two large inspection ports 180° apart
Modular construction system
4 different stator - rotor geometries available for most sizes
Low Maintenance expenses

General characteristics	
name plate on the pump	in English (Stainless steel)
direction of rotation	To the left, counter clockwise(as viewed from drive end)

Pump Pedestal	Cast Iron

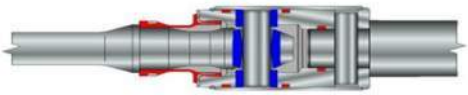
Pump housing / End connection	
Housing material	Cast Iron
Housing Connection position	Vertically Upwards (as viewed from drive end)
Function of housing connection	Suction Connection
Function of end connection	Discharge Connection
Suction Connection design	Standard
Nom. dia. & pressure for pump housing	6" 125# ANSI Flange
Discharge Connection design	standard
Nom. dia. & pressure of discharge flange	4" 125# ANSI Flange
Housing seals	FKM

Shaft seal	
Design	Single Mechanical Seal
Shaft seal type	Netzsch uNS-100
Shaft seal materials	SiC v SiC faces, Viton Elastomers, 316SS hardware - Q1Q1VGG



Rotating parts	
Extension shaft Material	AISI 420 - Steel
Coupling Rod Material	AISI 420 - Steel
Coupling Rod Design	Standard

Joints	
Joint type	SM Pin Joint with Wear Bushing
Joint sealing material	Buna/316 Stainless Steel
Joint lubrication	Mineral Oil



Rotor	
Rotor material	SAE 4140 VCP - Chrome Plated Steel
Rotor Size	Standard
Temperature range	32-84°F

Stator	
Stator material	NEMOLAST® O62L iFD 2.0 (Buna)

"Materials of construction are only recommended based on the information provided. Customer needs to verify materials will be compatible with the process fluid or application."

Drive

Premium Efficient Gearmotor	
Manufacturer	Nord
Type	SK672.1F-132SP/4
Flange diameter (mm)	250
Shaft diameter (mm)	40
Cross drill diameter (mm)	14
Cross drill position–measured from IEC face according to WN0146	33
Output speed n2 @60Hz (RPM)	350
Output speed min/max (RPM)	70/350
Gear Ratio	5.06
Mounting position	M1
Power (HP)	7.5
Voltage range (V)	230/460
Frequency (Hz)	60
Min/max frequency (Hz)	12/60
Number of poles / phases	4/3
Motor speed n1 @60Hz (RPM)	1770
Protection type / insulation class	IP55/F

Baseplate:	Carbon steel (top-hat profile)		
Arrangement	Inline		
Options	☐ 4" Grout Holes	☐ Anchor bolts	☐ Casters and handle bar
	☐ Motor mount shims	☐ Lifting lugs	☐ 0.75" Drip Rim w/0.75" NPT drain plug

Approximate Weights – (lbs.)	
Bareshaft Pump	334
Complete Assembly	529

NM063--01L

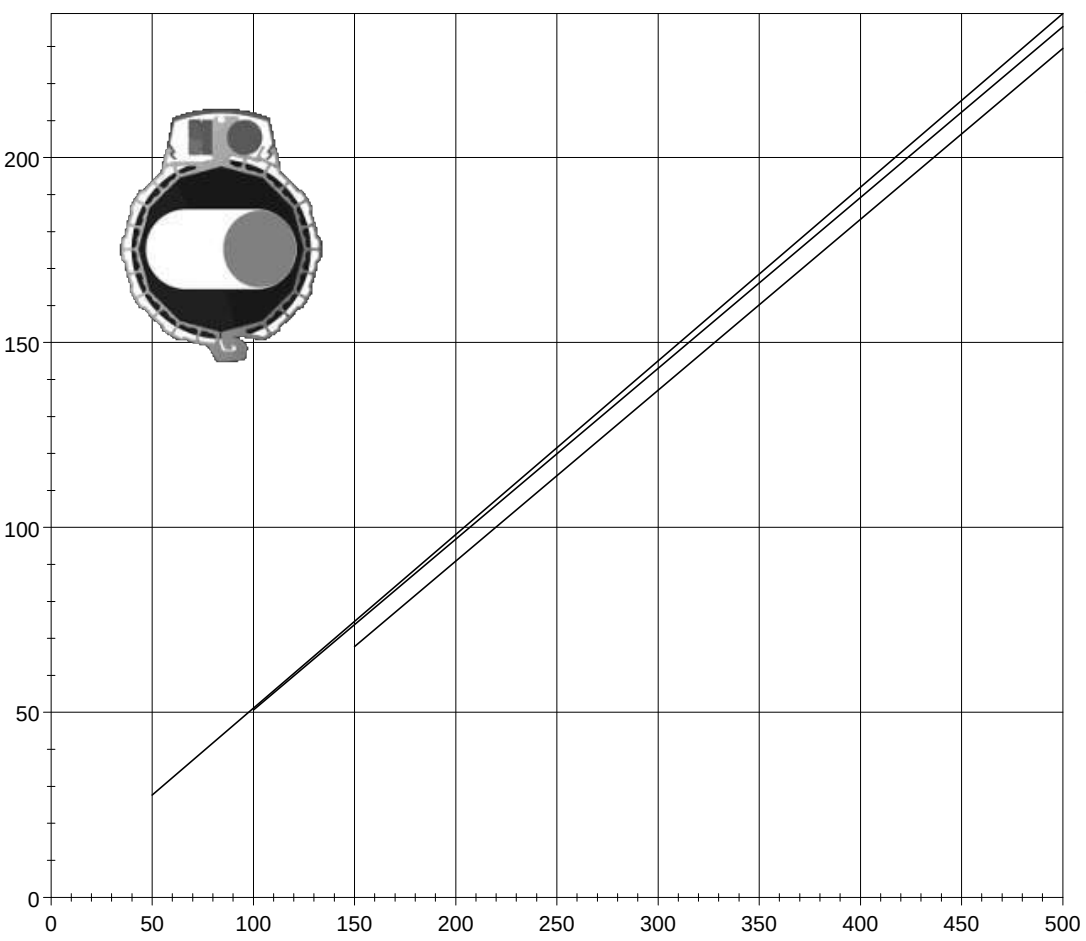
iFD-Stator® 2.0

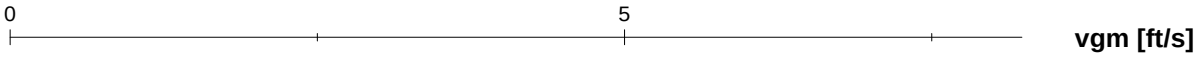
Performance Curve

elastomer quality: standard

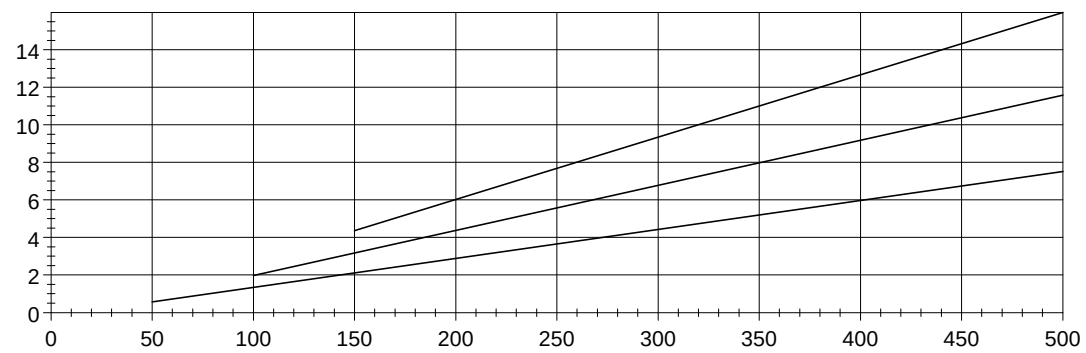
NETZSCH

GPM





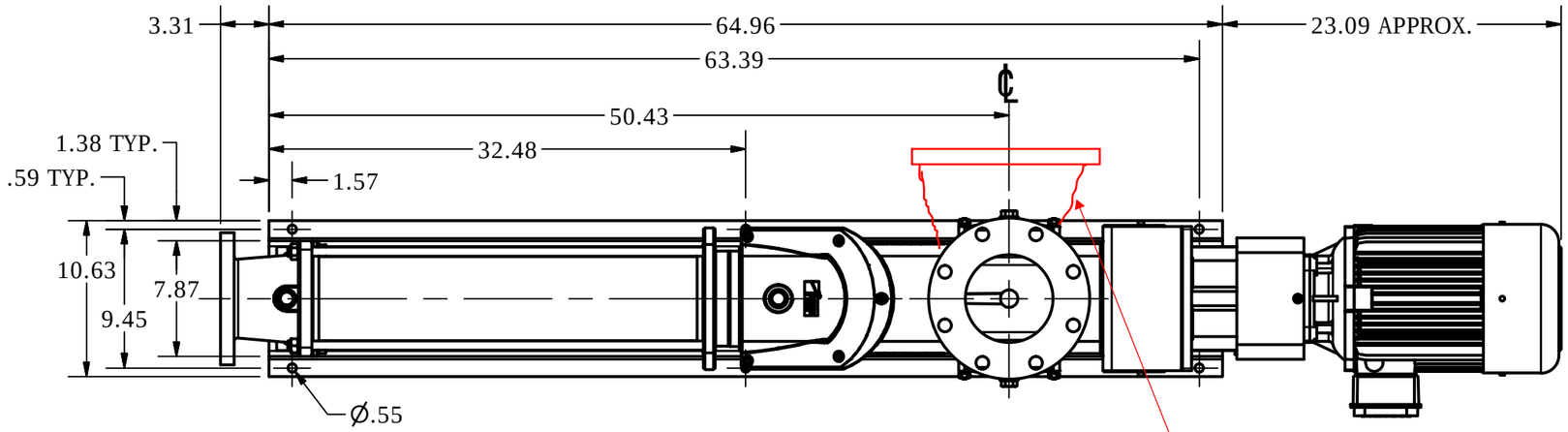
HP

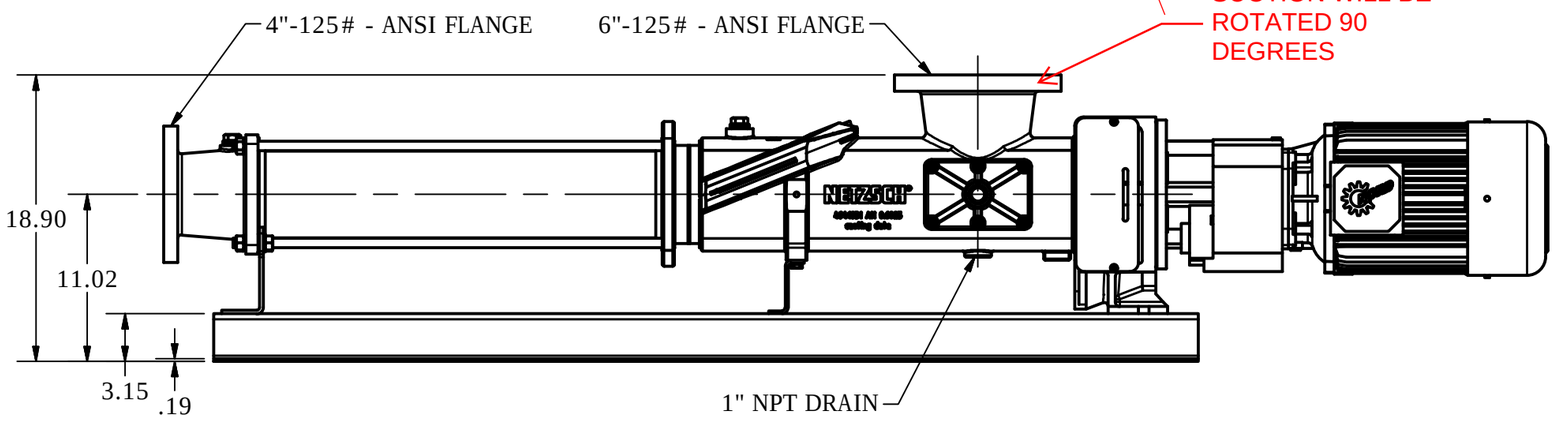


starting torque T(L) = 148 lbft

pressure	T
29 psig	79 lbft
58 psig	122 lbft
87 psig	169 lbft

Valid for water (1 cP) at 20 °C (70 °F). Tolerances are in accordance with VDMA 24284 tolerance group II.





NOTES:

A) DO NOT SCALE.
B) TOLERANCE Ñ0.25"
C) ALL DIMENSIONS ARE IN INCHES.
D) BASEPLATE FABRICATION-STRUCTURAL STEEL.
E) CLEAN OUT PORTS STANDARD ONLY ON CAST IRON.
F) APPROXIMATE WEIGHT OF PUMP ASSY, 698 lbs.

ASSEMBLIES REQUIRED		
0	063BY20-0	BASEPLATE ASSEMBLY
1	SEE BOM	GEARMOTOR, REDUCER
2	VERTICAL	SUCTION ORIENTATION

PROPRIETARY: DRAWING MAY NOT BE USED OR REPRODUCED WITHOUTWRITTEN AUTHORIZATION OF NETZSCH PUMPS NORTH AMERICA, LLC.

REV.	DESCRIPTION	BY	DATE	APP'D.
0	RELEASED TO SALES/MFG.	MT	2/3/2017	RL

NETZSCH PUMPS NORTH AMERICA, LLC.
EXTON, PA 19341 - 1393

TITLE: NM063BY 01L07/02S14/01P05/02D09/.1/.2/.3

DRAWN: MT DATE: 11/8/2016 | CHK'D: | DATE:

SCALE: 1:10 | APP'D: | DATE:

SHEET NUMBER: 1 OF 1

ORDER/PROJECT NUMBER

SIZE | DRAWING NUMBER | SHT | REV

B-063BY20.3

PART 6:
DRY CAKE AUGER

1. The auger is a 9" shaftless type. Auger is a total length of 20' (not including the auger motor).

2. Auger housing is a trough type. It is constructed from stainless steel. The auger shall have removable stainless steel covers.

3. Two supports are provided to support the auger at 3degree angle. The supports are constructed from stainless steel. One support is the back plate, the other will be located to allow the last 8' of the auger to be cantilevered.

4. The sludge inlet on the auger is a stainless steel hopper, designed to capture cake from belt.

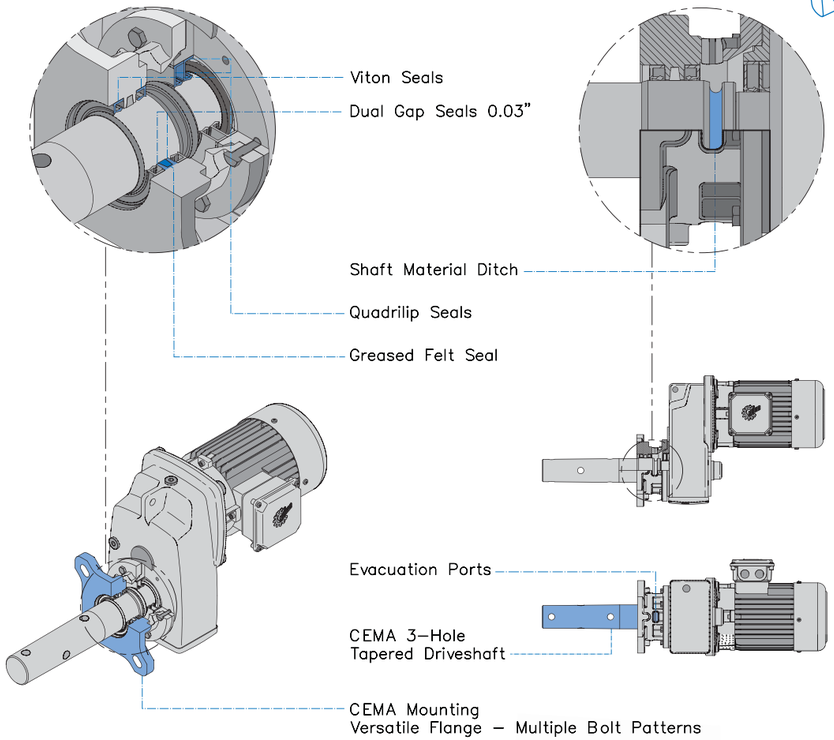
5. The auger flight is shaftless micro alloy steel flight with full pitch. Flight shall ride on a polypropylene liner.

6. Auger drive is a NORD SK3282 SCP, constant speed gear reducer with a speed of 31 rpm, TEFC, 3/60/230 – 460 motor, Horse Power will be 2.

7. An adjustable amp overload switch is provided to stop the entire dewatering system during overload conditions and indicate an alarm condition at the control panel.

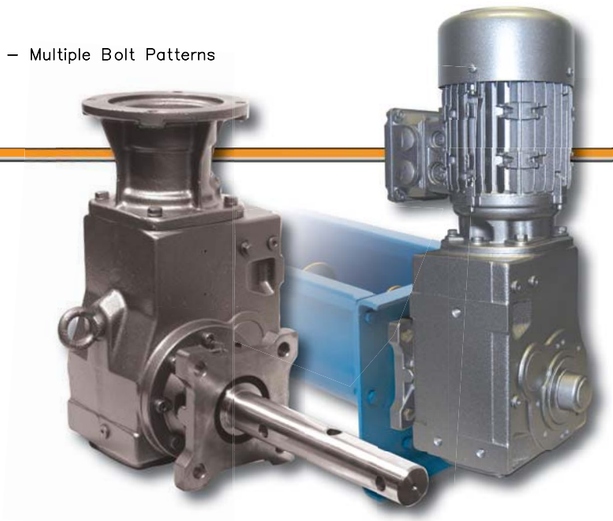
8. Auger is supplied with auger motor power wires run in conduit. A junction box on the belt press skid adjacent to the final position of the auger will also be provided. All parts required for connecting the auger electrically to the belt press will be provided. Electrical connection will be made on site by others.

Standard Features



ADAPTABILITY

Finally, due to modular flexibility of design, NORD speed reducers accept a variety of power inputs, including integral motors, input shafts, motor adapters, motor platforms, and variable speed drives.



NORD DRIVESYSTEMS
www.nord.com

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National Customer Service Toll-Free: 888.314.6673
info.us@nord.com

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10020011/0612

Intelligent Drivesystems

SCREW CONVEYOR PACKAGE

Gearmotors & Speed Reducers

F1129

NORD DRIVESYSTEMS

Simple, Reliable & Efficient

Simplicity - the NORD SCP screw conveyor package eliminates the need for costly separate V-belt drives by providing integral gearmotors or direct coupled motors to a NEMA C-face reducer.

SCP - PRODUCT FEATURES

OPTIMIZED SEALING SYSTEM
- Dual Viton lip seals
- Grease impregnated packing seal
- Dual gap seals (excludes particles) – 0.03" gap
- Material evacuation ports
- Shaft material ditch
- Quadrilip™ sealing

MOUNTING
- Standard CEMA mounting
- Versatile flange – multiple bolt patterns
- 3-Hole tapered CEMA drive shaft
  - Easy mounting
  - Easy removal (less fretting – due to less material contact)
- Reduced bearing loads – tapered shaft allows for screw pipe misalignment
- Quick external removal feature

FLANGE
- Standard CEMA mounting
- High strength class 35 gray cast iron
- Versatile flange – multiple bolt patterns

HIGH EFFICIENCY

The NORD SCP design is extremely effective due to the direct coupled gearmotor or NEMA C-face input design. Belted input systems have significantly lower total drive performance. You can further increase the overall efficiency by applying the NORD "H" line of energy efficient motors.

Standard Features

INNOVATION

UNICASE™ design principle. All speed reducer housings are constructed of a rigid, one-piece cast iron that resists deflection under the heaviest loading conditions. All bearings and seal seats are contained within the single casting, eliminating splits or bolt-on carriers that can weaken the housing or allow oil leakage.

NORD's oil-safe **QUADRALIP™** sealing system implements techniques that assure the lubricating oil stays inside the speed reducer, while contaminants, such as dirt and moisture, stay out. It features three seal lips, plus a grease-filled chamber and garter springs to ensure secure sealing at the shaft surfaces.

The **AUTOVENT™** breather controls the pressure inside the gear case during operation by regulating airflow. Also, the AUTOVENT™ breather prevents bearing damage by impeding entry of foreign material (water, dust, corrosives, etc.) to preserve the cleanliness of the atmosphere, and oil, inside the gear case.

All NORD speed reducers and motors feature high performance **Stainless Steel Protective Paint** – a durable resin pigmented with stainless steel for extra corrosion resistance and durability. The internal housing is coated with a quick-drying, one-pack synthetic primer that locks in any residual casting sand and seals any imperfections.

PARALLEL HELICAL CLINCHER™ RATINGS

Model type	Max Torque	Ratio Range	Speed Range	Gear Stages	Eff.	CEMA Drive Shaft				
	[lb-in]	[x:1]	[rpm]		[%]	1-1/2"	2"	2-7/16"	3"	3-7/16"
SK1282 SCP	2620	4.79 - 109.5	365 - 16	2	97	X	X	X		
SK1382 SCP	2425	87.94 - 624.45	20 - 2.8	3	95	X	X	X		
SK2282 SCP	4611	4.51 - 127.51	388 - 14	2	97	X	X	X		
SK2382 SCP	4894	82.22 - 763.41	21 - 2.3	3	95	X	X	X		
SK3282 SCP	8363	4.48 - 112.23	391 - 16	2	97	X	X	X	X	
SK3382 SCP	9195	89.60 - 1022.42	20 - 1.7	3	95	X	X	X	X	
SK4282 SCP	16089	4.7 - 155.4	372 - 11	2	97		X	X	X	
SK4382 SCP	18381	86.83 - 1585.08	20 - 1.1	3	95		X	X	X	
SK5282 SCP	28630	4.32 - 134.03	405 - 13	2	97		X	X	X	X
SK5382 SCP	28320	82.72 - 1367.08	21 - 1.3	3	95		X	X	X	X
SK6282 SCP	40152	4.39 - 80.33	399 - 22	2	97				X	X
SK6382 SCP	53100	24.42 - 551.58	72 - 3.2	3	95				X	X

RIGHT-ANGLE HELICAL BEVEL RATINGS

SK9012.1 SCP	3540	8.09-332.37	216-5.3	3	95	X	X	X		
SK9013.1 SCP	3540	141.29-1690.1	12-1.0	4	95	X	X	X		
SK9022.1 SCP	7611	8.78-276.86	199-6.3	3	95	X	X	X		
SK9023.1 SCP	7611	228-47-1899.26	7.7-0.92	4	95	X	X	X		
SK9032.1 SCP	13718	8.48-295.85	206-5.9	3	95	X	X	X	X	
SK9033.1 SCP	13728	167.45-3635.95	10-0.48	4	95	X	X	X	X	
SK9042.1 SCP	24780	8.83-329.69	198-5.3	3	95		X	X	X	X
SK9043.1 SCP	24780	172.08-4246.38	10-0.41	4	95		X	X	X	X
SK9052.1 SCP	42480	8.10-289.61	216-6.0	3	95				X	X
SK9053.1 SCP	42480	164.99-3735.92	11-0.47	4	95				X	X

NORD DRIVESYSTEMS

PART 7: CONTROL PANEL

1. The control panel is a 480 VAC, 3 phase, 60 Hertz, NEMA 4X, stainless steel enclosure and shall contain all electrical controls, wires, starters, terminals, relays, overloads, VFDs, Programmable Logic Controller, fuses and labels required for operation of the belt press and ancillary equipment described herein.

2. The system is fully operational in both manual and automatic modes. The system mode selector switch shall allow the operator to select the desired mode. No other changes or programming by the operator are required.

3. Programmable Logic Controller (PLC) provides automatic sequenced equipment start up and shutdown. Start-up sequence turns on the equipment in an ordered manner, turning on drive motors and pumps as required and preparing polymer solution for injection into the waste stream. During automatic mode operation the automatic belt tracking system, sludge cake monitoring system and emergency shutdown features monitor and shutdown the entire system in the event of the failure or overloading of any circuit, motor or system. Shutdown sequence removes all waste material from belt press and flushes the polymer dosing system leaving both clean and ready for the next operation period. Following the clean down phase a solenoid on the water line shuts off water supply to system. Automated shutdown sequence requires no operator intervention whatsoever.

4. The solid state PLC provides the following functionality:
    1. An LCD display with pre-programmed alarm fault messages to speed up resolving system shutdown faults
    2. Timers for start-up and shutdown are adjustable on the PLC display
    3. Program is password protected
    4. No programming device is needed for trouble shooting PLC

5. The front of the control panel door shall include a main disconnect breaker switch (power on/off). In the off position all power to the control panel is off. An E Stop, and the HMI touch screen display.

6. The operator interface will include the following switching and indication:
    1. System on/off
    2. System green/on and red/fault lights
    3. System fault reset
    4. System mode selector “Manual -Automatic”
    5. Belt Press on/off
    6. Belt Press green/running light
    7. Belt Press speed controller for VFD
    8. Flocculator on/off
    9. Flocculator green/running light
    10. Flocculator speed controller for VFD
    11. Sludge Pump on/off
    12. Sludge Pump green/running light
    13. Sludge Pump speed controller for VFD
    14. Sludge Pump speed readout display
    15. Wash water pump on/off switch

16. Wash water pump green/running light
17. Auger #1 on/off
18. Auger #1 green/running
21. Polymer system on/off
22. Polymer system green/running
23. E-stop pushbutton
24. Hours running meter
25. Top belt tracking extend/retract
26. Bottom belt tracking extend/retract
27. Extend/Retract Top Belt tension
28. Extend/Retract Bottom Belt tension

7. The control panel emergency circuit immediately shuts down all equipment and a red fault light will come on under the following conditions. In addition PLC mounted LCD display shows message describing specific fault when general fault light is on. The fault is retained in all listed conditions until reset with system fault reset pushbutton. The conditions are:

    1. Pressing E-stop pushbutton on control panel
    2. Pulling emergency pull cable surrounding belt press
    3. Belt press limit switches being activated by belt tracking to a mis-aligned position
    4. Load Cell limit reached
    5. The unexpected de-energizing or overloading of any circuit within the control panel
    6. The No Sludge Cake system being activated when there is no sludge discharge from belt press

8. The No Sludge Cake Sensor monitors sludge cake production at set time intervals. The default time interval is 1 minute. This can be easily adjusted by the operator using the PLC touch pad in the control panel. In the event the system does not detect sludge cake being produced the No Sludge Cake System causes the entire belt press system and ancillary to automatically stop and an alarm condition is activated. The PLC will display the following message “No sludge cake detected”

9. Control Description:

    a. Local Mode:
        1. Turn system mode selector switch to Local.
        2. Operate each equipment item by start/stop pushbuttons.

    b. Auto Mode: When the “Start” pushbutton is selected, an automatic program will sequentially:
        1. Start the belt drive
        2. Start the wash water booster pump, polymer feed pump and open belt wash water solenoid valve for both systems.
        2. After the belts are wetted start sludge transfer pump.
        3. Then start-up auger system.
        4. Activate Sludge Monitoring System following successful start-up.

c. Auto Mode: When the “Stop” pushbutton is selected, an automatic program will sequentially:
    1. Stop the sludge transfer pump and polymer feed pump.
    2. Continue for an adjustable timed cycle to allow the press belt to completely discharge the sludge cake and wash the belt and flush polymer unit.
    3. After a timed interval, stop the auger, the belt press drive and wash water booster pump.

d. Both belts will have independent automatic belt tracking and tensioning systems.

10. PLC display messages:

    E-STOP ACTIVATED

    SYSTEM IN MANUAL MODE

    BELT PRESS BELT MISALIGNMENT…CHECK BELT

    VFD FAULT…CHECK ALL VFD’S

    MOTOR OVERLOAD TRIPPED…CHECK ALL MOTOR STARTERS

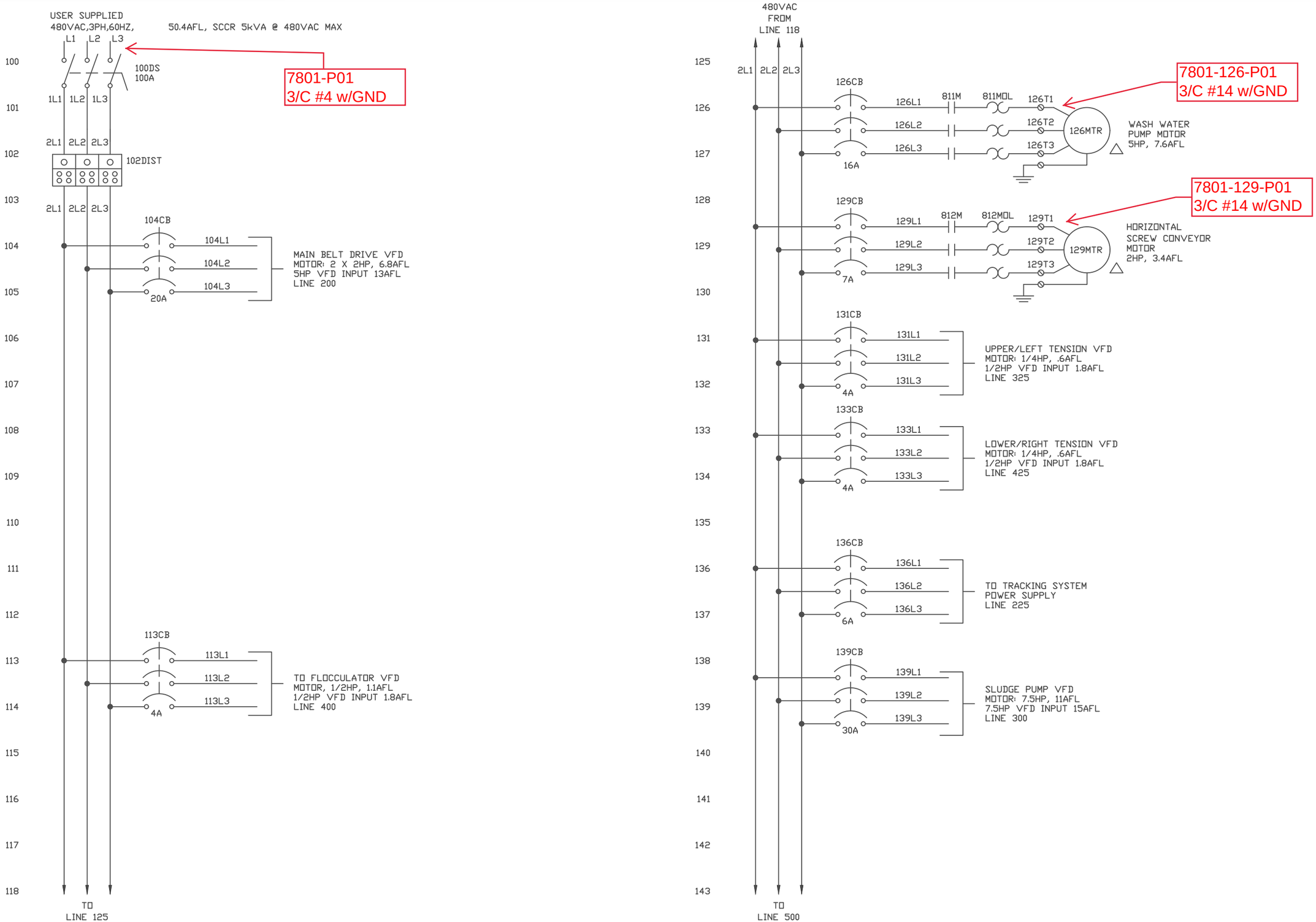
    NO SLUDGE DETECTED ON BELT

    AUTO SHUTDOWN SEQUENCE ACTIVATED

    AUTO SHUTDOWN COMPLETE…PRESS SYTEM ON TO BEGIN AGAIN

    SYSTEM OPERATING IN AUTOMATIC MODE

11. Control Panel will be mounted on the skid, piped and wired.



LET.	REVISIONS	DATE	BY	CK
A	SUBMITTALS	10/11/2021	TMM	

SOUTH SHORE CONTROLS INC.
9395 PINECONE DR. MENTOR, OH 44060 PH: (440) 259-2500

TITLE:
GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT #J2729-01

CUSTOMER:
OR-TEC INCORPORATED

DRN. BY	ENG.	CAD FILE	DRAWING NO.	SHEET
TMM	TMM	OPP2630E001	OPP2630E001	1
DATE 10/11/2021	SCALE	PROJECT NO. J2729-01		OF 9

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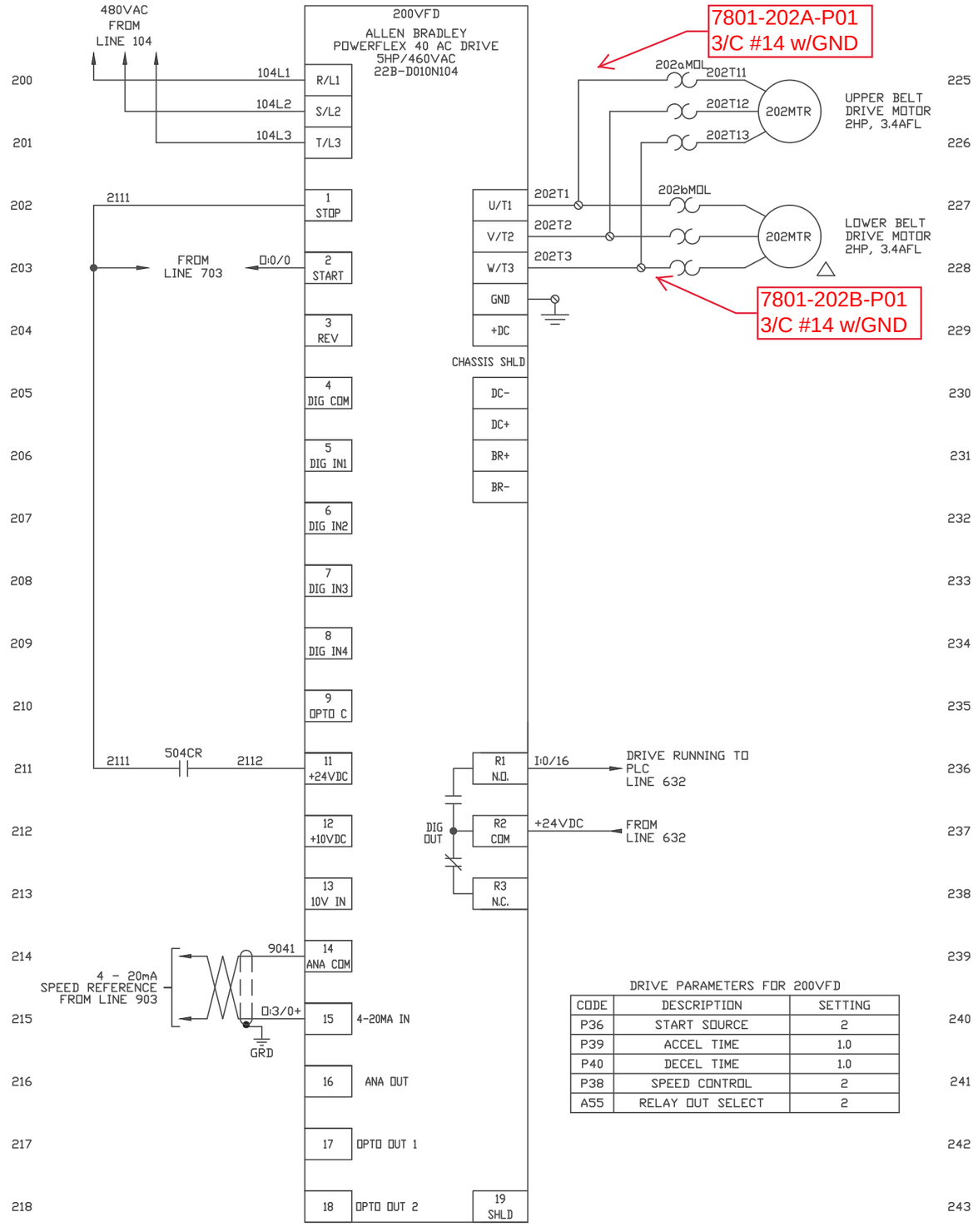
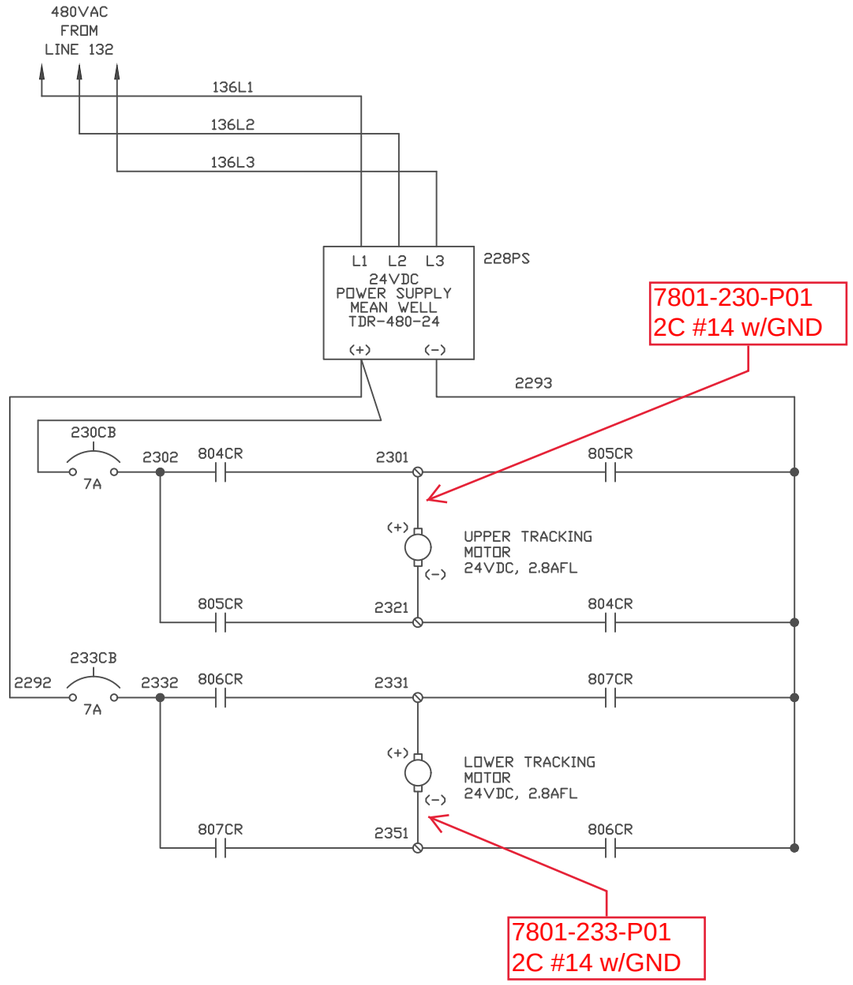
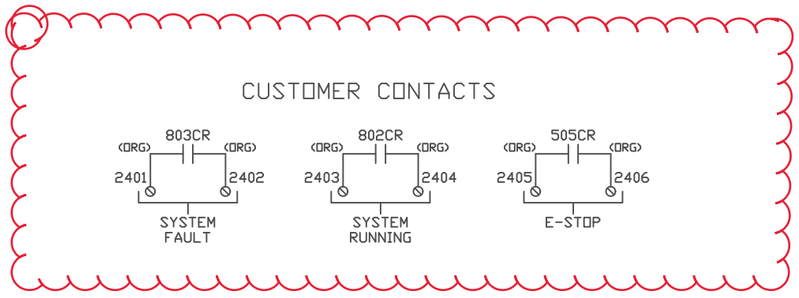


DRIVE PARAMETERS FOR 200VFD

CODE	DESCRIPTION	SETTING
P36	START SOURCE	2
P39	ACCEL TIME	1.0
P40	DECEL TIME	1.0
P38	SPEED CONTROL	2
A55	RELAY OUT SELECT	2





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TITLE:
GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER:
OR-TEC INCORPORATED

DRN. BY	ENG.	CAD FILE	DRAWING NO.	SHEET
TMM	TMM	OPP2630E002	OPP2630E002	2
DATE	SCALE	PROJECT NO.		OF
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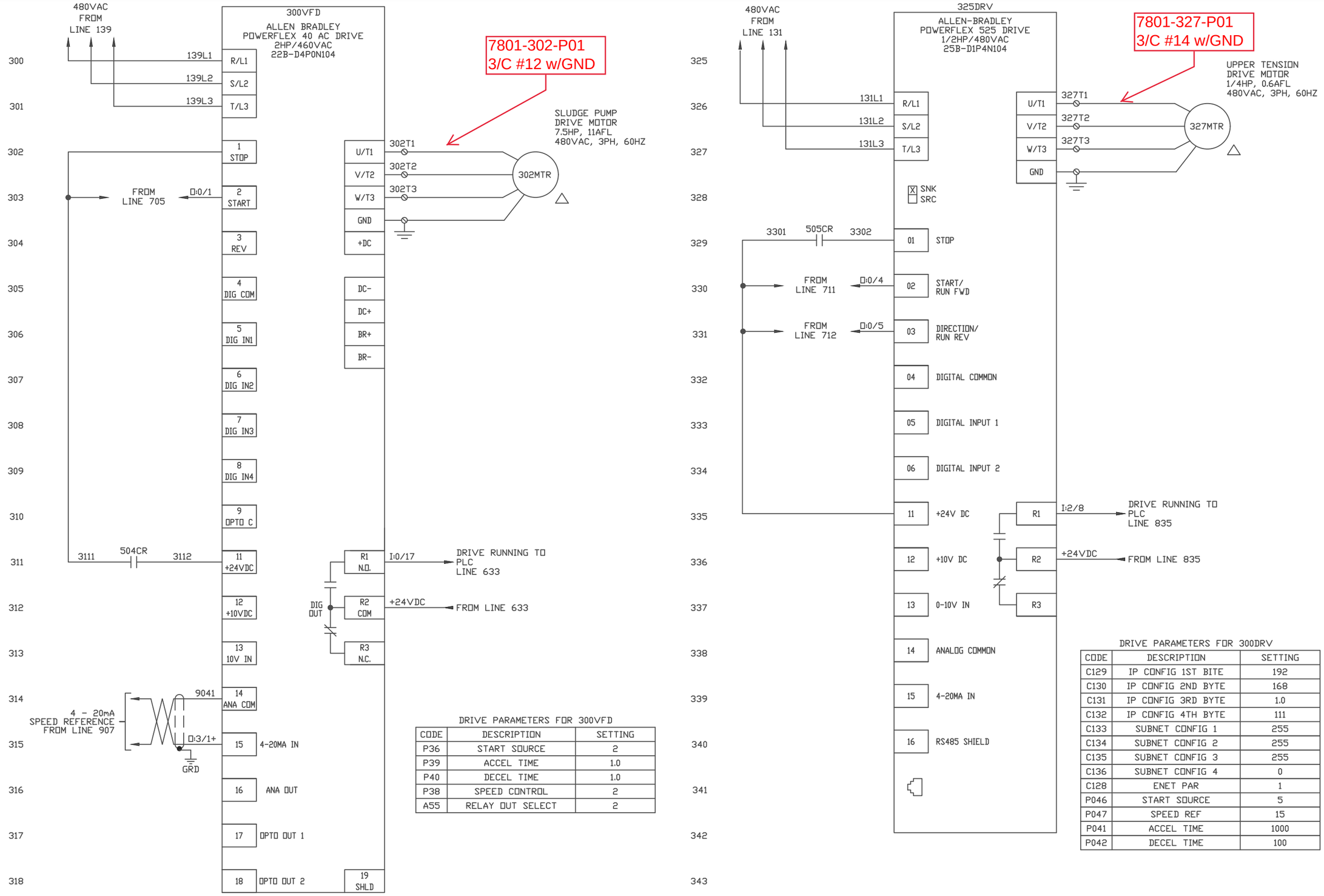

DRIVE PARAMETERS FOR 300VFD

CODE	DESCRIPTION	SETTING
P36	START SOURCE	2
P39	ACCEL TIME	1.0
P40	DECEL TIME	1.0
P38	SPEED CONTROL	2
A55	RELAY OUT SELECT	2

DRIVE PARAMETERS FOR 300DRV

CODE	DESCRIPTION	SETTING
C129	IP CONFIG 1ST BITE	192
C130	IP CONFIG 2ND BYTE	168
C131	IP CONFIG 3RD BYTE	1.0
C132	IP CONFIG 4TH BYTE	111
C133	SUBNET CONFIG 1	255
C134	SUBNET CONFIG 2	255
C135	SUBNET CONFIG 3	255
C136	SUBNET CONFIG 4	0
C128	ENET PAR	1
P046	START SOURCE	5
P047	SPEED REF	15
P041	ACCEL TIME	1000
P042	DECEL TIME	100

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GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER:
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DATE 10/11/2021	SCALE	PROJECT NO. J2729-01		OF 9

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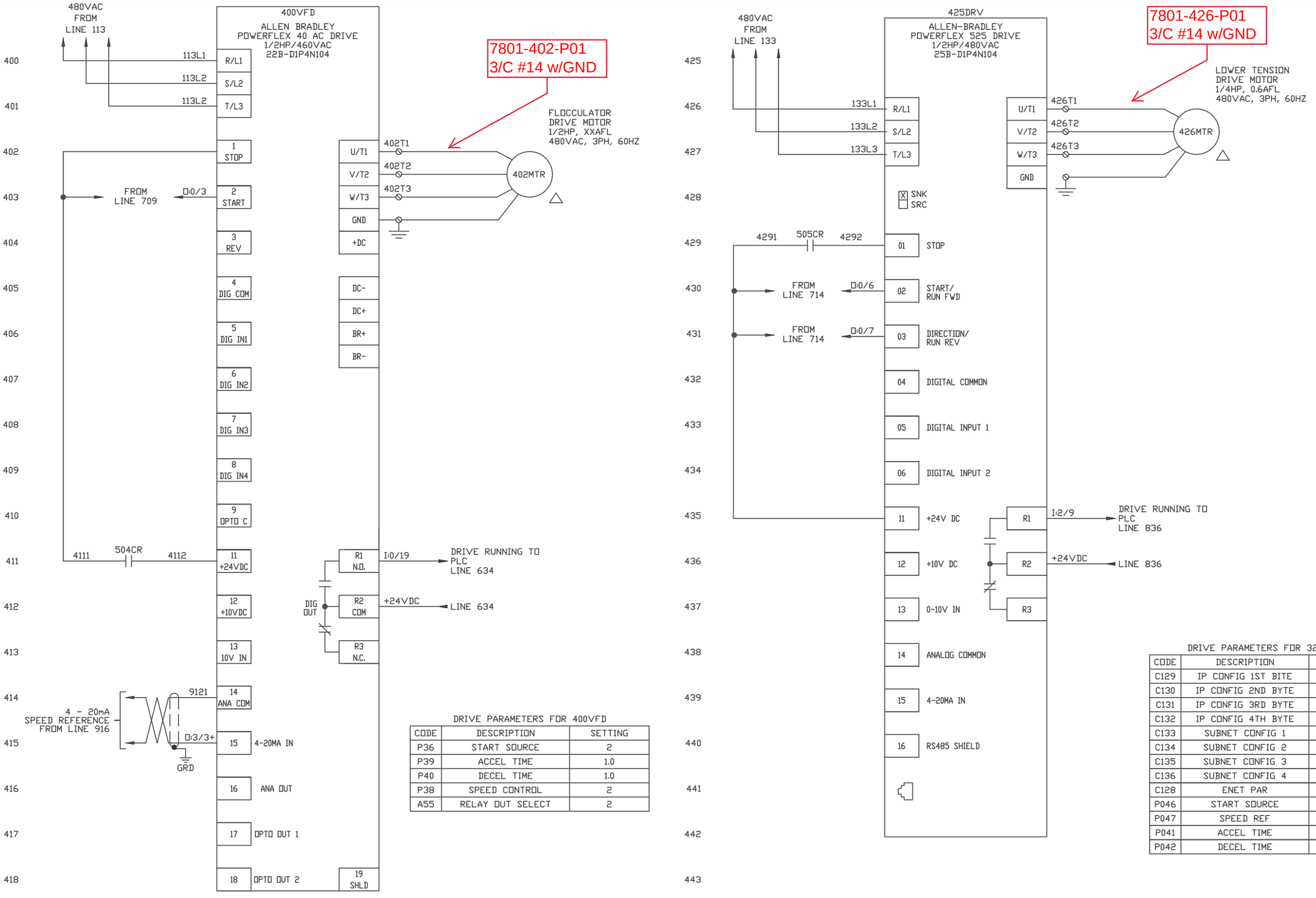

DRIVE PARAMETERS FOR 400VFD

CODE	DESCRIPTION	SETTING
P36	START SOURCE	2
P39	ACCEL TIME	1.0
P40	DECEL TIME	1.0
P38	SPEED CONTROL	2
A55	RELAY OUT SELECT	2

DRIVE PARAMETERS FOR 325DRV

CODE	DESCRIPTION	SETTING
C129	IP CONFIG 1ST BITE	192
C130	IP CONFIG 2ND BYTE	168
C131	IP CONFIG 3RD BYTE	1.0
C132	IP CONFIG 4TH BYTE	112
C133	SUBNET CONFIG 1	255
C134	SUBNET CONFIG 2	255
C135	SUBNET CONFIG 3	255
C136	SUBNET CONFIG 4	0
C128	ENET PAR	1
P046	START SOURCE	5
P047	SPEED REF	15
P041	ACCEL TIME	1000
P042	DECEL TIME	100

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A	SUBMITTALS	10/11/2021	TMM	

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TITLE:
GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER:
OR-TEC INCORPORATED

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DATE 10/11/2021	SCALE	PROJECT NO. 2729-01		OF 9

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480VAC FROM LINE 143

501CB
2L2
2L1
501H4
501H1
6A
480VAC
H1 H3 H2 H4
502T 1KVA
X1 X3 X2 X4
120VAC

503CB
5031
5032
5033
10A

5041 5042 504RS1 5043 5044
504PB
ROPE SW

504 CR — E-STOP RELAY 211,311,336,411

505 CR — E-STOP RELAY 240,603

729CR
507FU 5A
5072
507REC
TEC BLEND PUMP RECEPTACLE

730CR
5091
509FU 2A
5092
509SOL
SLUDGE SUPPLY SOLENOID

811M
5101
510FU 2A
5102
510SOL
WASH WATER SOLENOID

TO LINE 525

5033
TO LINE 525

FROM LINE 518
5031

526PS
24VDC POWER SUPPLY
L N
(+) (-)
+24VDC1
24VCOM

+24VDC
528CB 10A
529CB 2A
5291

529DIT
HMI TOUCH SCREEN
EA9-T10WCL
ETHERNET
24VCOM

530SW
PHOENIX
1085039

ETHERNET TO LINE 601

531LC
(RED) D,F +INPUT
(BLK) C,E -INPUT
(GRN) A +OUTPUT
(WHT) B -OUTPUT

533SC
1 2 3 4
8 7 6 5
I:4/0+
I:4/0-
4-20mA TO PLC LINE 928

+24VDC
24VCOM

537LC
(RED) D,F +INPUT
(BLK) C,E -INPUT
(GRN) A +OUTPUT
(WHT) B -OUTPUT

539SC
1 2 3 4
8 7 6 5
I:4/1+
I:4/1-
4-20mA TO PLC LINE 931

+24VDC
24VCOM

5031 +24VDC
TO LINE 600

24VCOM 5033
TO LINE 600

FROM LINE 518
5033

PANELVIEW PLUS COMPACT 1000
ETHERNET SWITCH (5 PORT)
UPPER TENSION LOAD CELL
UPPER TENSION SIGNAL CONDITIONER
LOWER TENSION LOAD CELL
LOWER TENSION SIGNAL CONDITIONER

Customer would like local HMI/E-Stop station Can we add a NEMA 4X HMI enclosure with E-Stop?

Simplest way to integrate this into existing plant control system would be to network this PLC with fiber. Can we switch this to an N-Tron 708FX switch?

7801-504-C01
2/C #14 w/GND

7801-507-P01
2/C #14 w/GND

7801-509-C01
2/C #14 w/GND

7801-510-C01
2/C #14 w/GND

7801-531-T01
4/C #18 SH

7801-537-T01
4/C #18 SH

LET.	REVISIONS	DATE	BY	CK
A	SUBMITTALS	10/11/2021	TMM	

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TITLE: GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER: OR-TEC INCORPORATED

DRN. BY	ENG.	CAD FILE	DRAWING NO.	SHEET
TMM	TMM	OPP2630E005	OPP2630E005	5
DATE 10/11/2021	SCALE	PROJECT NO. J2729-01		OF 9

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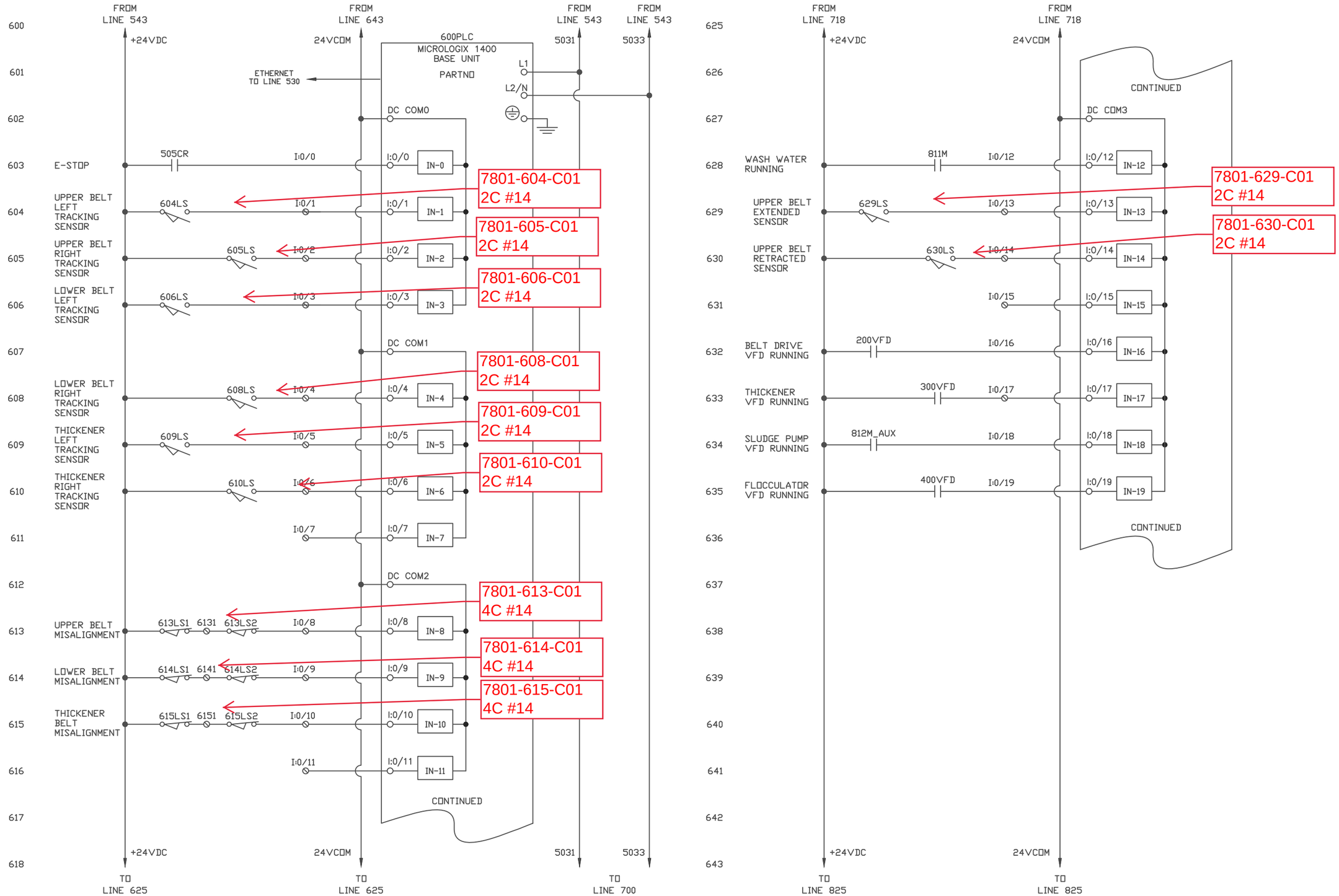

LET.	REVISIONS	DATE	BY	CK
A	SUBMITTALS	10/11/2021	TMM	

SOUTH SHORE CONTROLS INC.
9395 PINECONE DR. MENTOR, OH 44060 PH: (440) 259-2500

TITLE:
GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER:
OR-TEC INCORPORATED

DRN. BY	TMM	ENG.	TMM	CAD FILE	OPP2630E006	DRAWING NO.	OPP2630E006	SHEET	6
DATE	10/11/2021	SCALE		PROJECT NO.	J2729-01			OF	9

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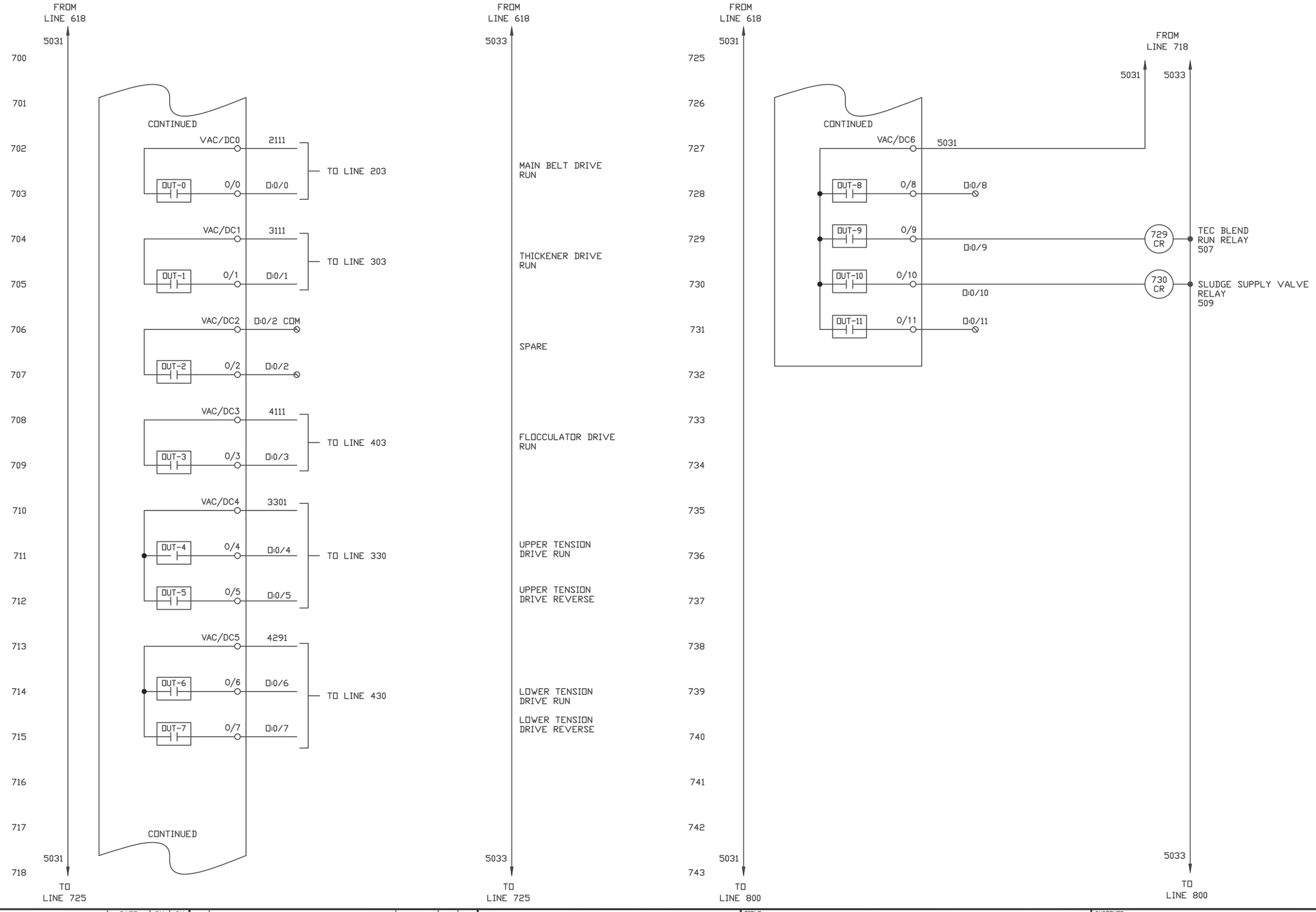

LET.	REVISIONS	DATE	BY	CK
A	SUBMITTALS	11/10/2021	TMM	

SOUTH SHORE CONTROLS INC.
9395 PINECONE DR. MENTOR, OH 44081 PH: (440) 259-2500

TITLE: GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER: OR-TEC INCORPORATED

DRN. BY	ENG.	CAD FILE	DRAWING NO.	SHEET
TMM	TMM	OPP2630E007	OPP2630E007	7
DATE 10/11/2021	SCALE	PROJECT NO. J2729-01		OF 9

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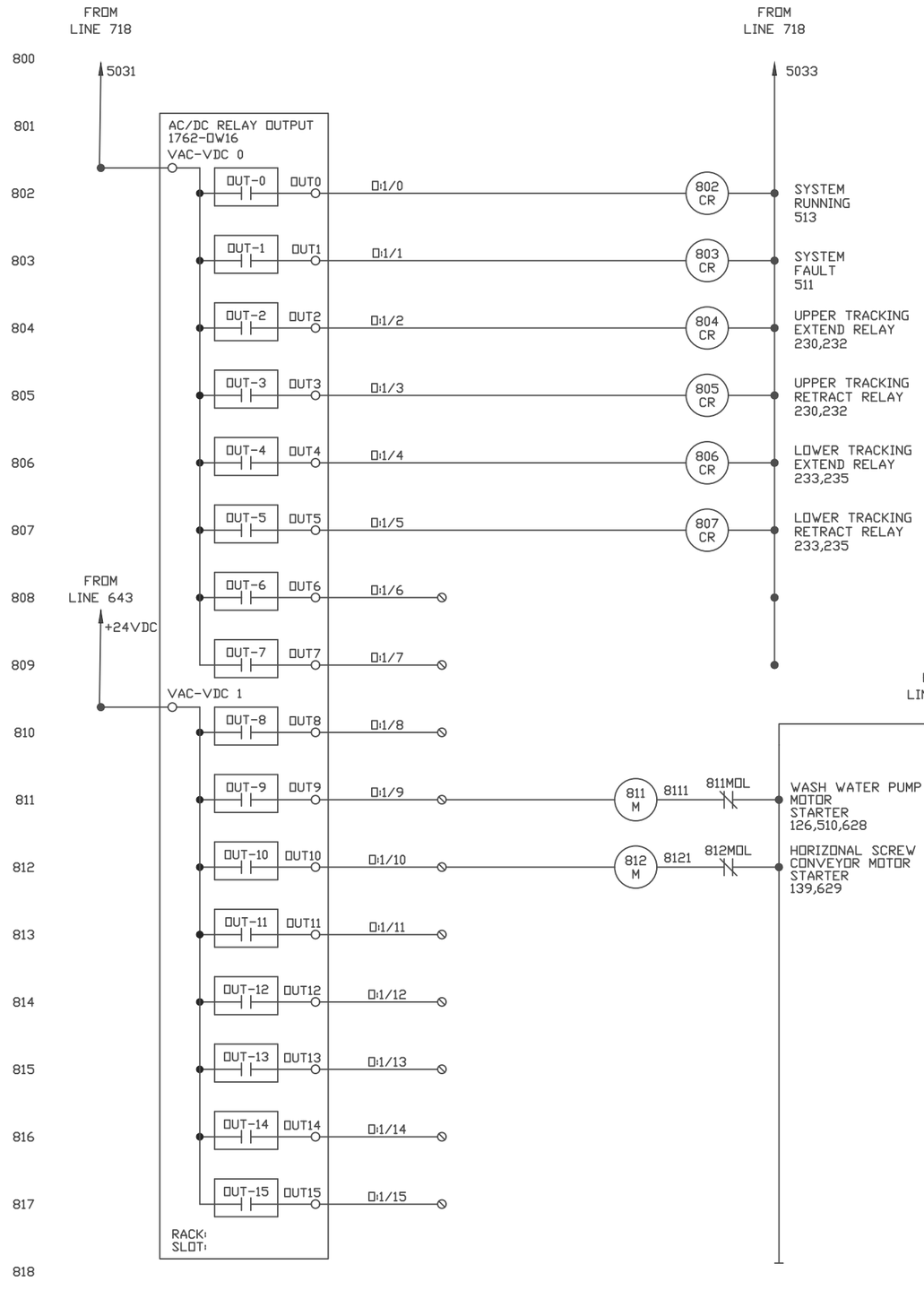

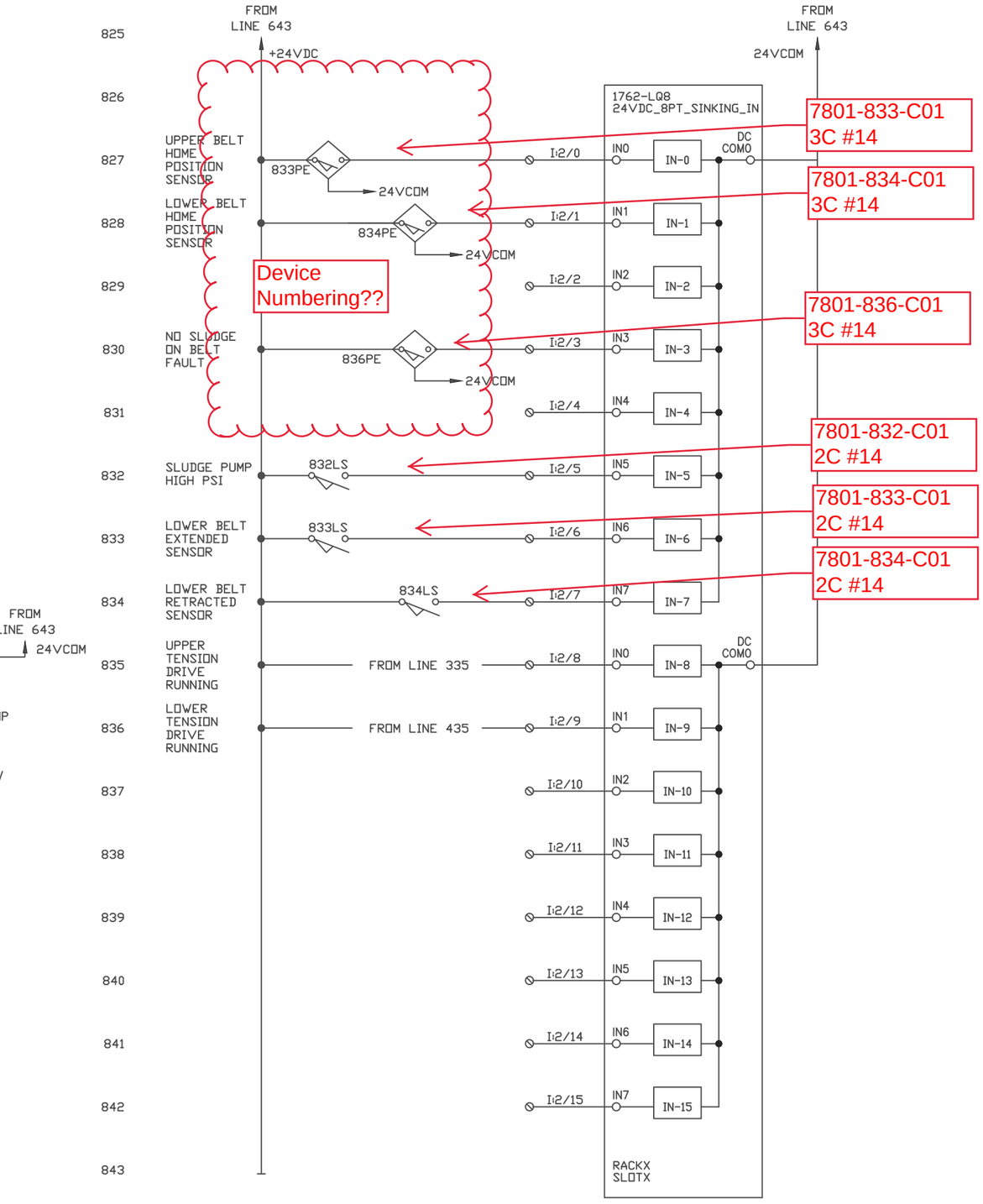

LET.	REVISIONS	DATE	BY	CK
A	SUBMITTALS	10/11/2021	TMM	

SOUTH SHORE CONTROLS INC.
9395 PINECONE DR. MENTOR, OH 44061 PH: (440) 259-2500

TITLE: GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER: OR-TEC INCORPORATED

DRN. BY	TMM	ENG.	TMM	CAD FILE	DPP2630E008	DRAWING NO.	DPP2630E008	SHEET	8
DATE	10/11/2021	SCALE		PROJECT NO.	J2729-01			OF	9

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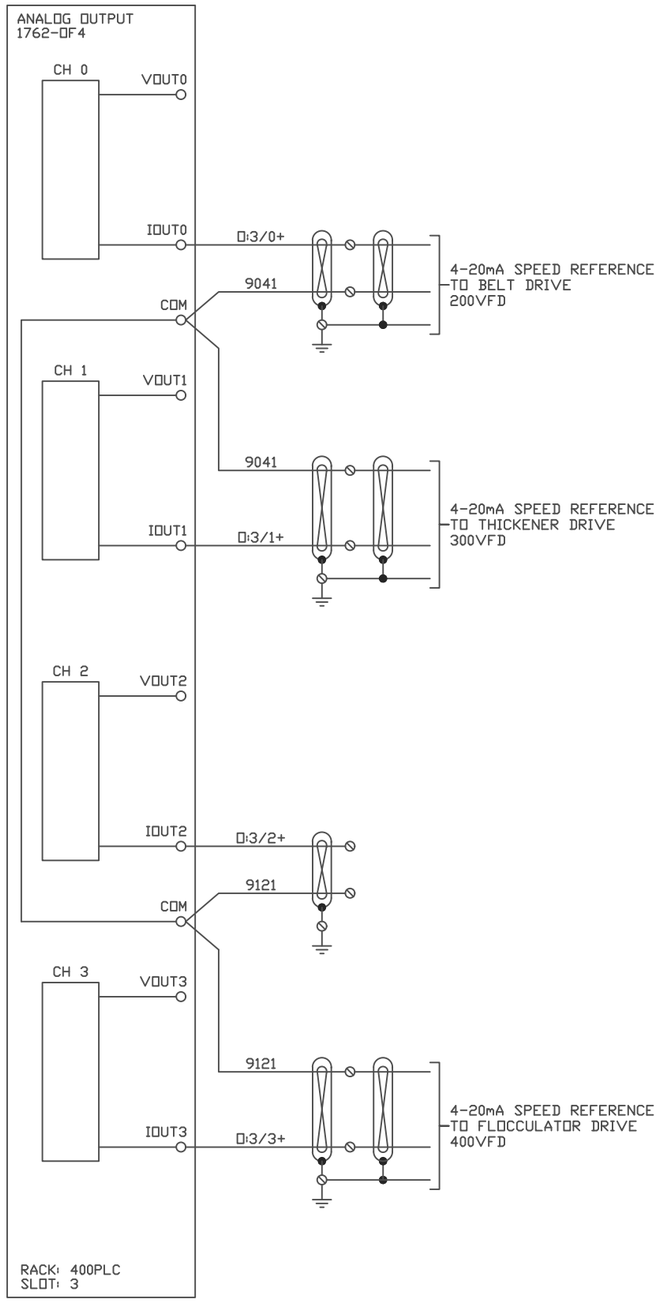

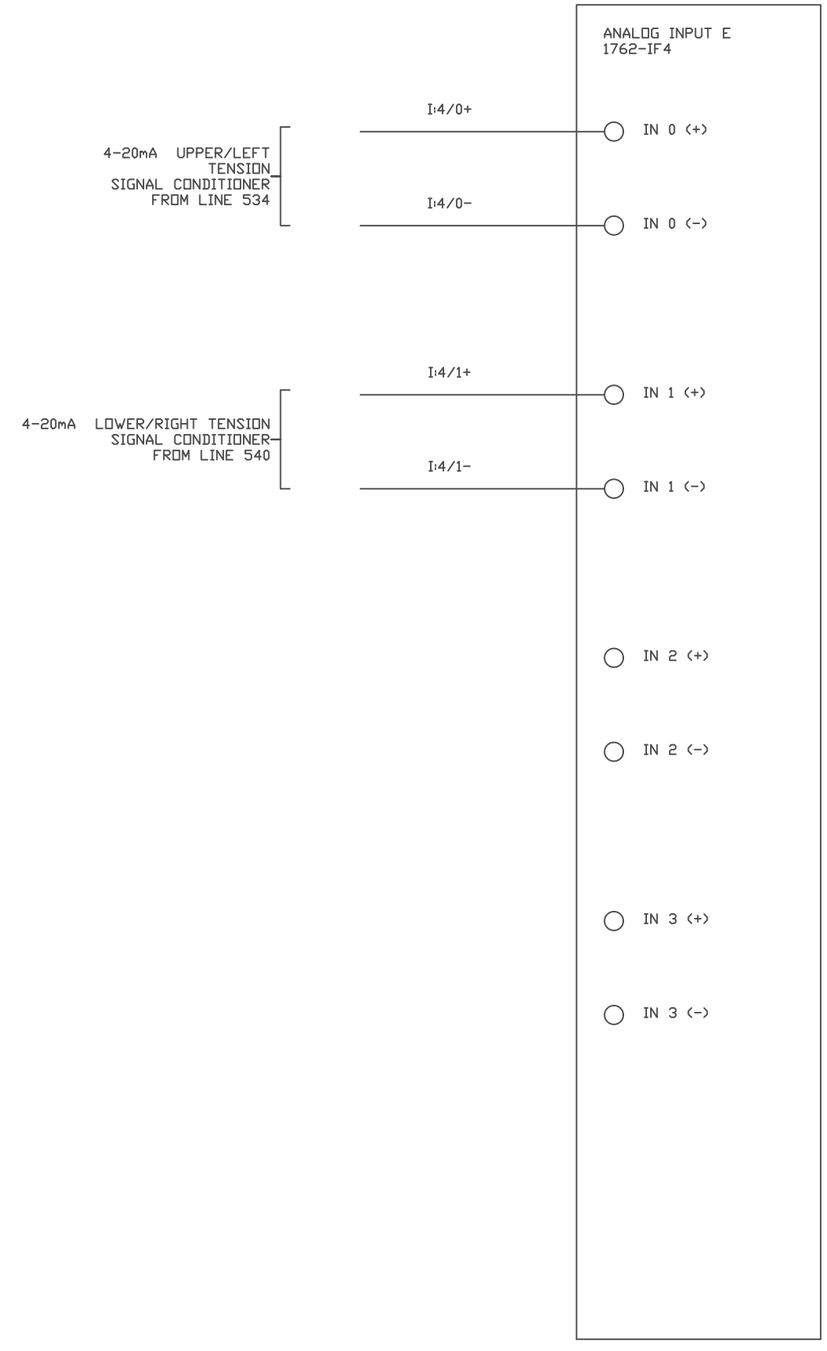

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A	SUBMITTALS	10/11/2021	TMM	

SOUTH SHORE CONTROLS INC.
9395 PINECONE DR. MENTOR, OH 44060 PH: (440) 259-2500

TITLE: GEMINI 1700 BELT PRESS MARQUETTE COUNTY
ELECTRICAL SCHEMATIC
OR-TEC PROJECT J2729-01

CUSTOMER: OR-TEC INCORPORATED

DRN. BY	ENG.	CAD FILE	DRAWING NO.	SHEET
TMM	TMM	OPP2630E009	OPP2630E009	9
DATE 10/11/2021	SCALE	PROJECT NO. J2729-01		OF 9

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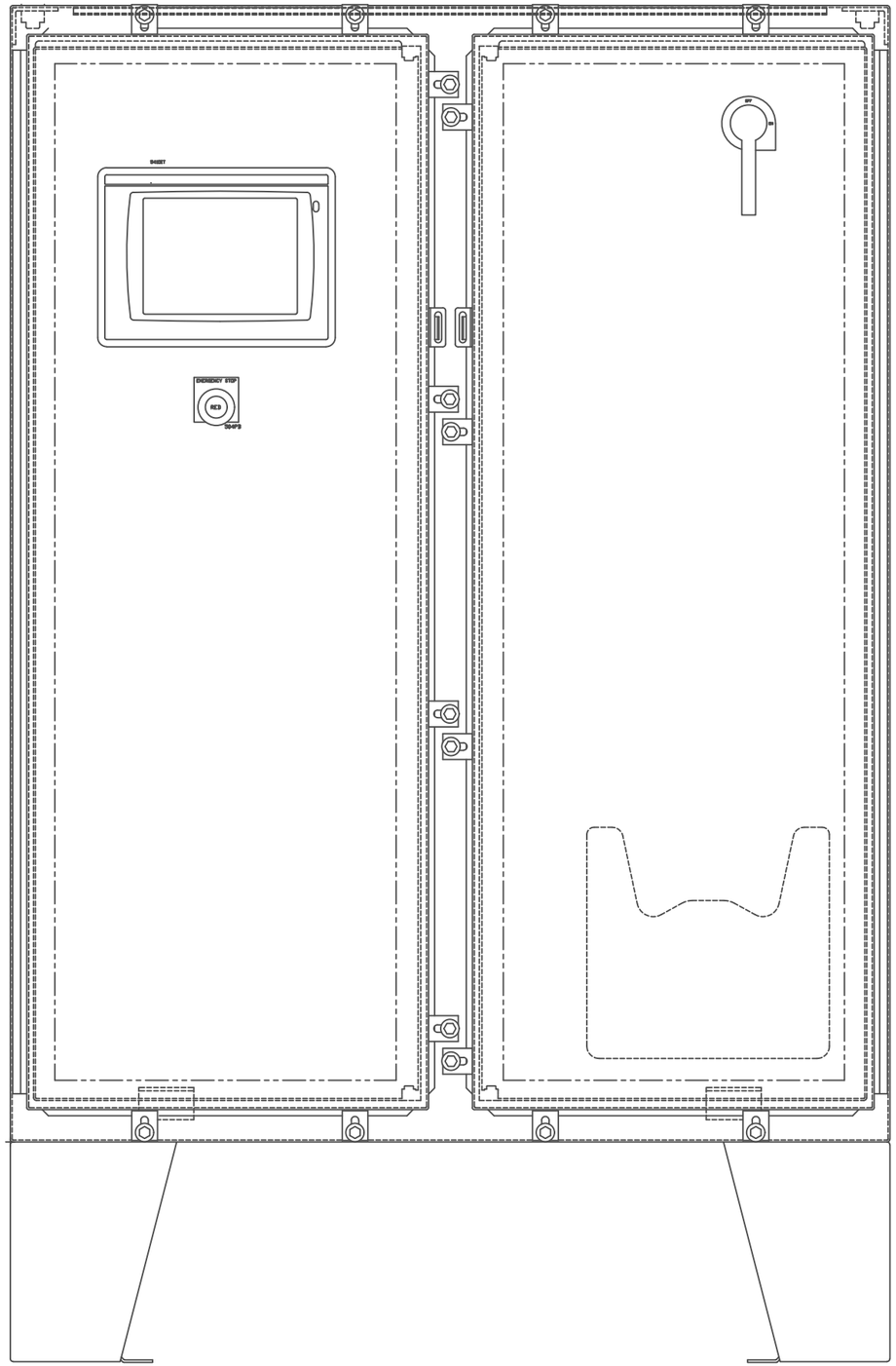

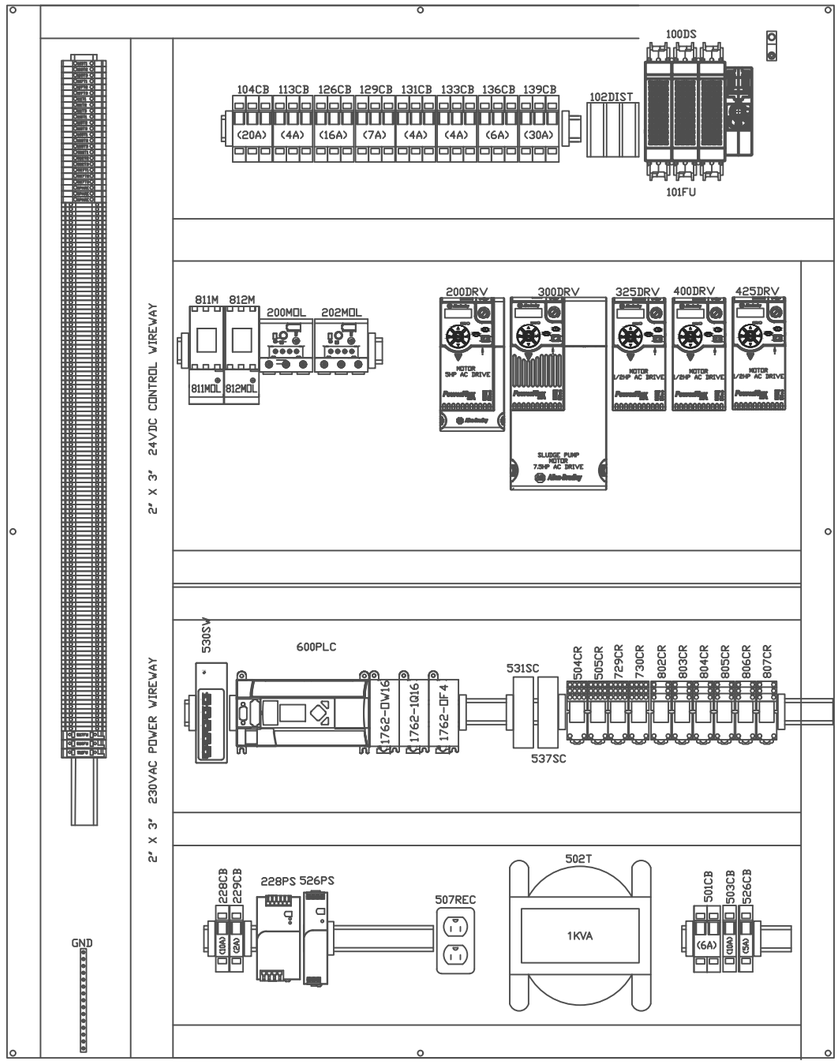

LET.	REVISIONS	DATE	BY	CK
A	FOR SUBMITTAL	10/11/2021	TMM	TMM

SOUTH SHORE CONTROLS INC.
4823 NORTH RIDGE RD. PERRY, OH 44081 PH: (440) 259-2500

TITLE:
GEMINI 1700 BELT PRESS MARQUETTE COUNTY
BELT PRESS CONTROL PANEL
PANEL LAYOUT

CUSTOMER:
OR-TEC, INC

DRN. BY	TMM	ENG.	TMM	CAD FILE	OPP2630M001	DRAWING NO.	OPP2360M001	SHEET	1
DATE	10/11/2021	SCALE		PROJECT NO.	J2729-01			OF	7

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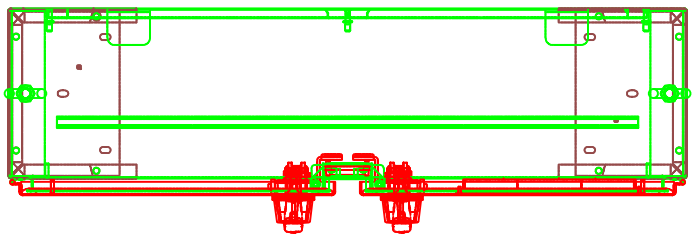
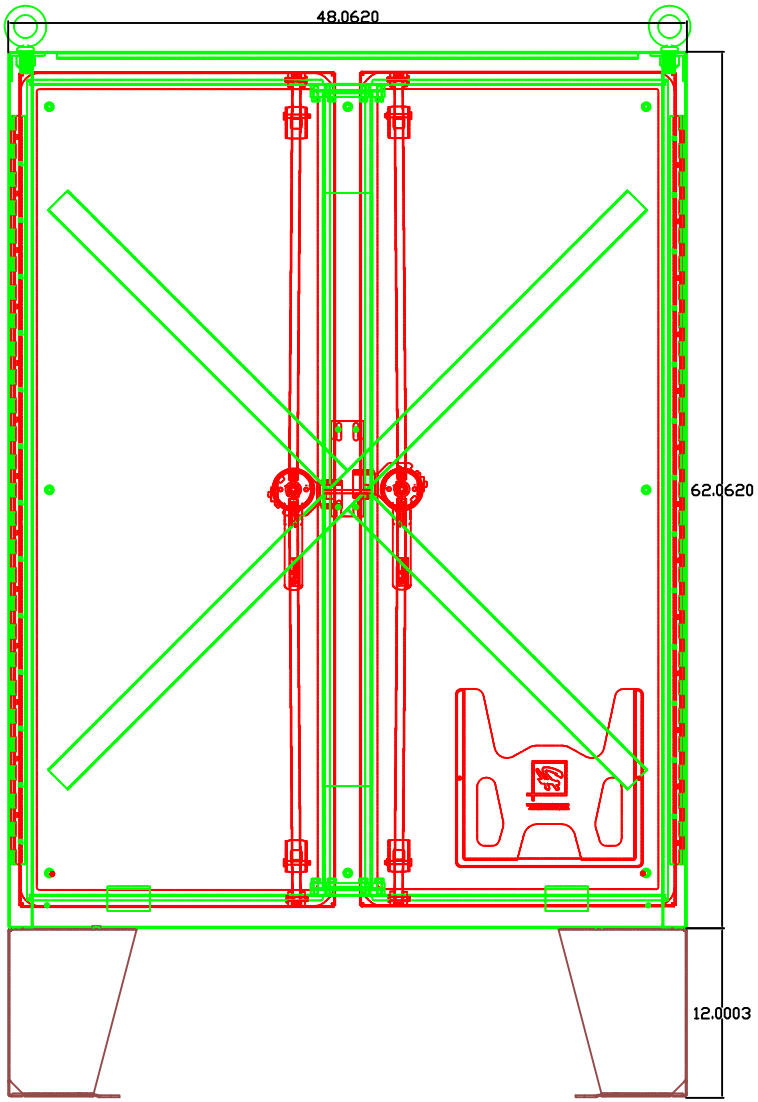
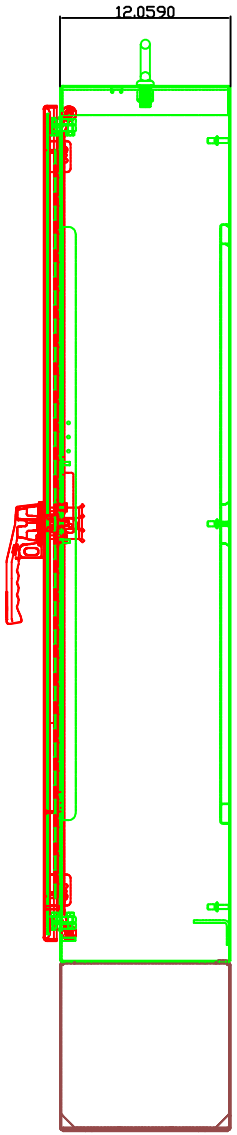
HOFFMAN
A62H4812SSLP3PT, A62H4812SS6LP3PT

(DATA SUBJECT TO CHANGE WITHOUT NOTICE)







87785532 REV E
MJT-00002679 12/19/12

Part 8 -Trailer

1. The Belt Press, control panel, polymer system, wash water pump, sludge pump, Stainless Steel auger auger shall be trailer mounted

2. The trailer shall be 19 foot 8 inch long by 8 foot wide. There is a 4'x8' Beaver tail. The deck height is 34 inch tall.

3. All interconnecting piping, wiring, valves, gauges, etc shall be provided.

4. Trailer will be of sufficient size to haul Gemini Belt press. Trailer will have a 14,000 GVW with a 10,000 lbs capacity.

   Trailer will be type Moritz International. Moritz International will not provide specific details of trailer until time of purchase. There is no manufactures data available for this Submittal at this time.

PART 9
DELIVERY, WARRANTY & START UP

1. Equipment will be delivered to jobsite on the trailer. Or-Tec will not unload or position the auger.

2. All mechanical components, are warranted for 12 months after startup.

   Items (scraper blades, gravity drainage skirting, pump stators and impellers) are warranted for one year. Dry running of pumps or damage caused by the introduction of foreign material into pumps is not covered by warranty.

3. Manufacturer's Factory personnel will be present at the job site for a minimum of 2 days, travel time excluded, for inspection of installation, certification of field testing, start-up and training. During Startup Or-Tec will review the Operation Manuals with the client to make sure all operators present during startup will be trained.

PART 10 - SLUDGE PUMP OVERPRESSURE PROTECTION DEVICES

ONYX VALVE
835 Industrial Hwy, Cinnaminson, NJ 08077
phone: 856-829-2888 | Fax: 856-829-3080 | onyxvalve.com

PSW

The Onyx Isolator Ring provides a simple, accurate method to measure pressure of slurries and corrosive fluids. The PSW series is compatible with flanged pipe connections. Nesting inside the bolt circle of mating flanges provides accurate alignment and minimum weight at the lowest installed cost.

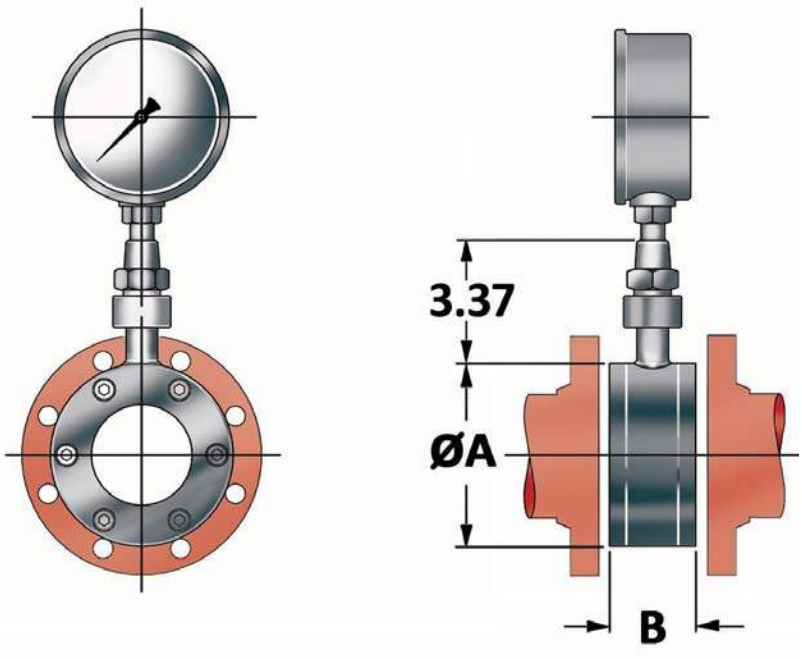
The inside diameter of the PSW precisely matches standard pipe for smooth, unobstructed flow, self-cleaning operation, and minimum turbulence and friction. Onyx ultra-deep vacuum filling insures the highest accuracy in the industry. The patented "Module Seal" - standard on all Onyx Isolator Rings - allows instruments to be or replaced or calibrated without interrupting the process.

Materials of Construction

Center Section:	Carbon Steel*	Carbon-Kynar Coat	316 Stainless Steel
End Plates:	Acetal (Standard) 316 Stainless Steel Teflon	Kynar Titanium	UHMW-PE Carpenter-20
Elastomer: (*Available with optional Teflon coatings)	Nitrile (Buna-N) EPDM* (Nordel*) Neoprene Viton* Hypalon	-30°F →220°F -40°F →300°F -20°F →220°F -15°F →375°F -10°F →250°F	
Fill Fluid:	Silicone Fluid Food Grade Silicone	-40°F →400°F -20°F →400°F	
Module Seal Stinger Fitting:	Brass	316 Stainless Steel	
Pipe Fittings:	Carbon Steel	316 Stainless Steel	
Pressure Range:	Vacuum to +1,000 psi	The Onyx Isolator ring has been tested by an independent lab to 1,500 psi.	

Benefits Listed:

- Absolute immunity to clogging
- Combines accurate alignment, reduced weight, and maximum economy
- Mates with 150# flanges compatible with 300# or 600# flanges with adapters
- Superior accuracy compared to diaphragm seals
- No tools required to change pressure instrument
- High displacement design can operate up to three instruments on one ring



Size	ØA	B
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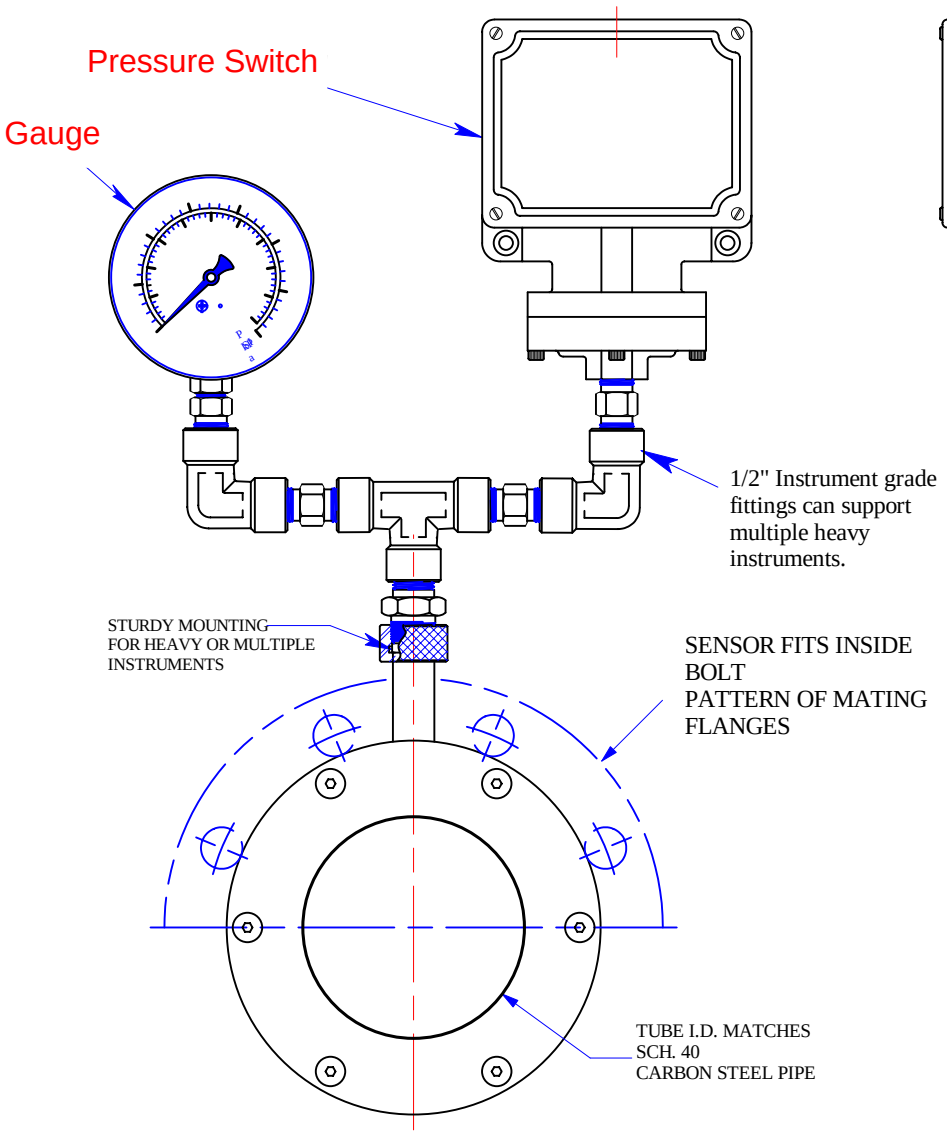
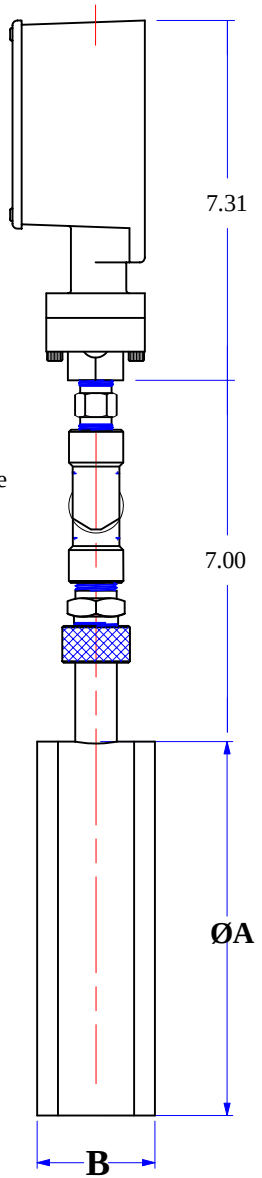
1 ½	3.25	1.87
2	4.00	1.87
2 ½	4.75	1.87
3	5.25	1.87
4	6.75	2.12
5	7.62	2.25
6	8.62	2.25
8	10.87	2.25
10	13.25	2.81
12	16.00	3.12
14	17.62	3.12
16	20.12	3.12
18	21.50	3.12
20	23.75	3.12
36	41.12	4.00





SIZE	ØA	B
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1-1/2	3.25	1.87
2	4.00	1.87
2-1/2	4.75	1.87
3	5.25	1.87
4	6.75	2.12
5	7.62	2.25
6	8.62	2.25
8	10.87	2.25
10	13.25	2.81
12	16.00	3.12
14	17.62	3.12
16	20.12	3.12
18	21.50	3.12
20	23.75	3.12
24	28.12	3.12

CENTER MATERIAL:
☐ CARBON STEEL

END PLATE MATERIAL:
☐ ACETAL

SLEEVE ELASTOMER: BUNA-N

PIPE FITTINGS MATERIAL(1/2 NPT STD):
Brass

FILL FLUID:
☐ SILICONE (STD) (-40° F TO 400° F)

SERIES PSW

APPENDIX B

Prevailing Wages

"General Decision Number: MI20230135 01/06/2023

Superseded General Decision Number: MI20220135

State: Michigan

Construction Type: Building

County: Marquette County in Michigan.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $16.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2023.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	. Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $12.15 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2023.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

Modification Number	Publication Date
0	01/06/2023

ASBE0127-004 06/01/2022

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 36.59	25.56

BOIL0169-002 01/01/2021

	Rates	Fringes
BOILERMAKER	$ 35.95	34.52

BRMI0006-001 05/01/2020

	Rates	Fringes
BRICKLAYER	$ 27.30	22.54
TILE SETTER	$ 27.30	22.54

CARP1510-005 06/01/2020

	Rates	Fringes
MILLWRIGHT	$ 30.00	21.48

CARP1510-006 06/01/2020

	Rates	Fringes
CARPENTER (Including Acoustical Ceiling Installation, Drywall Finishing/Taping, Drywall Hanging, Form Work, and Soft Floor Layer - Carpet)	$ 25.15	20.90

ENGI0324-031 05/01/2022

	Rates	Fringes
POWER EQUIPMENT OPERATOR:		
Crane operator, main boom & jib 120' or longer	$ 36.41	24.60
Crane operator, main boom & jib 140' or longer	$ 38.73	24.60
Crane operator, main boom & jib 220' or longer	$ 39.02	24.60
GROUP 1	$ 34.51	24.60
GROUP 2	$ 31.36	24.60
GROUP 3	$ 29.96	12.10

Premium rate: main boom and jib 300 feet or longer is $1.50 per hour above the 220 ft. boom and jib rate. Main boom and jib 400 feet or longer is $3.00 per hour above the 220 ft. boom and jib rate.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: backhoe, bulldozer; crane, front end loader, excavator, paver, roller, and scraper (self-propelled and tractor drawn)
GROUP 2: fork truck
GROUP 3: oiler

IRON0008-008 06/01/2022

	Rates	Fringes
IRONWORKER, REINFORCING AND STRUCTURAL		
Contracts $10,000,000 or greater	$ 32.83	27.95
Contracts less than $10,000,000	$ 32.83	27.95

Paid Holidays: New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day & Christmas Day.

LABO1329-005 05/01/2022

	Rates	Fringes
LABORER		
Common or General; Mason Tender - Brick; Mason Tender - Cement/Concrete; and Sandblaster	$ 30.74	12.95
Pipelayer	$ 30.09	12.95

PAIN1011-001 06/02/2019

	Rates	Fringes
PAINTER (Insulator Foam Only)	$ 27.54	13.33

PLAS0016-037 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 20.17	10.13

PLUM0111-002 05/27/2022

	Rates	Fringes
PIPEFITTER (Excludes HVAC Pipe & System Installation)	$ 39.54	26.83
PIPEFITTER (HVAC Pipe Installation Only)	$ 36.39	26.25
PLUMBER (Excluding HVAC Pipe & System Installation)	$ 34.48	25.18

ROOF0149-014 05/01/2021

	Rates	Fringes
ROOFER	$ 26.50	15.95

SHEE0007-006 07/01/2017

	Rates	Fringes
SHEET METAL WORKER (Excluding HVAC Duct & System Installation)	$ 27.24	27.35
SHEET METAL WORKER (HVAC Duct & System Installation)	$ 27.24	27.35

SUMI2011-060 02/14/2011

	Rates	Fringes
GLAZIER	$ 17.50	2.27
LABORER: Landscape & Irrigation	$ 14.25 **	0.00
OPERATOR: Grader/Blade	$ 24.04	6.03
OPERATOR: Tractor	$ 19.60	7.31
PAINTER: Brush, Roller and Spray	$ 17.81	2.87
TRUCK DRIVER: Flatbed Truck	$ 17.44	4.51

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($16.20) or 13658 ($12.15). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate

(weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"