City of Owosso

Well Improvements
Shiawassee County, Michigan

DWSRF Project No. 7880-01

Project Manual
Fishbeck Project No. 241848

BIDS AND CONSTRUCTION

fishbeck
Engineers | Architects | Scientists | Constructors

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PROJECT MANUAL
FOR
CITY OF OWOSSO

WELL IMPROVEMENTS
SHIAWASSEE COUNTY, MICHIGAN

DWSRF Project Number 7880-01

April 16 2025
Fishbeck Project Number 241848

ENGINEER

FISHBECK
5913 Executive Drive, Suite 100
Lansing, Michigan 48911
517.882.0383

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SECTION 00 01 10 – TABLE OF CONTENTS

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SECTION 00 11 13 - ADVERTISEMENT FOR BIDS

City of Owosso

Well Improvements

1. RECEIPT OF BIDS

City of Owosso, the Owner, will receive sealed Bids for construction of the Well Improvements at the City Clerk's office at 301 W. Main Street, Owosso, Michigan 48867 until Tuesday, May 20, 2025 at 3 p.m., local time. No Bids will be received after that time. Bids will be publicly opened and read aloud at that time and place.

2. SCOPE OF PROJECT

The Project consists of furnishing all supplies for and constructing improvements to the filtration system and placing it in operation.

- Remove two existing well house buildings entirely, well and well pump to remain/protect. Construction of new well house buildings over top of two existing wells to include all process, electrical, HVAC. A third well is to be abandoned, remove existing building and all above grade items.

3. FINANCING

The Project will be financed with funds provided by Drinking Water State Revolving Fund (DWSRF) and the Contract Documents reflect requirements by that agency.

4. ISSUING OFFICE

Bidding Documents are being issued from Fishbeck's Lansing office. Bidders should direct questions and correspondence to Brian Van Zee, PE at bvanzee@fishbeck.com .

5. EXAMINATION OF DOCUMENTS

Bidding Documents may be examined at the following locations after April 18, 2025.

Fishbeck, 5913 Executive Drive, Suite 100, Lansing, Michigan 48911, 517.882.0383.

City of Owosso, 301 W. Main Street, Owosso, Michigan 48867.

Builder's Exchanges: Grand Rapids, Kalamazoo, Lansing, Tri-City Saginaw.

Construction Association of Michigan (CAM): Bloomfield Hills, Saginaw.

Central Michigan Plan Room: Mt. Pleasant.

A list of entities to whom the Bidding Documents have been issued will be available online at www.fishbeck.com. Click on "Bid Sets/Bidders Lists."

6. OBTAIN BIDDING DOCUMENTS

Bidding Documents may be obtained (ordered) online, go to www.fishbeck.com, click on "Bid Sets/Bidders Lists." PDF files that are viewable online are low resolution quality (i.e., not suitable for printing). Electronic downloads and printed sets are high resolution. Costs for printed sets of Bidding Documents are established by the reproduction service provider, including shipping (if applicable). Individuals/companies that purchase printed sets are automatically added to the list of plan holders. Obtaining Bidding Documents from any source not identified herein may result in failure to receive addenda, corrections, or other revisions that may be issued.

7. BID SECURITY

Bid security in the amount, form and subject to the conditions provided in the Instructions to Bidders must be submitted with each Bid.

8. WITHDRAWAL OF BIDS

Bids may not be withdrawn for a period of 90 days after the actual date of opening thereof. This time period may be extended by mutual agreement of the Owner and any Bidder or Bidders.

9. RIGHT TO REJECT BIDS

The Owner reserves the right to waive any irregularities and to reject any and all Bids.

10. PREBID CONFERENCE

A prebid conference will be held on April 30, 2025, at 10 a.m. local time at 1111 Allendale Ave, Owosso, MI 48867. Prospective Bidders are encouraged to attend and participate in the conference.

END OF SECTION 00 11 13

SECTION 00 21 13 - INSTRUCTIONS TO BIDDERS

ARTICLE 1 - DEFINED TERMS

1.01 Terms used in these Instructions to Bidders will have the meanings indicated in the General Conditions (Standard General Conditions of the Construction Contract, EJCDC, No. C-200, 2018 edition) and the Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof:

A. Issuing office – the office identified in the Advertisement for Bids, from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

ARTICLE 2 - COPIES OF BIDDING DOCUMENTS

2.01 Complete sets of the Bidding Documents in the number and for the cost stated in the Advertisement for Bids may be obtained as indicated in the Advertisement for Bids If a deposit is identified as being refundable, the deposit will be refunded to each document holder of record who returns a complete set of Bidding Documents in good condition within 30 days after opening of Bids.

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

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

ARTICLE 3 - QUALIFICATIONS OF BIDDERS

3.01 Each Bid shall contain evidence of Bidder's qualification to do business in the state where the Project is located or Bidder must covenant to obtain such qualification prior to award of the Contract.

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

3.03 To demonstrate Bidder’s qualifications to perform the Work, within 5 days of Owner's request Bidder shall submit written evidence of:

A. Financial data, previous experience, present commitments, workers' compensation experience modification rating (EMR) and other such data as may be requested by Owner.

B. Previous experience in constructing at least 3 projects of a similar type, comparable size and comparable complexity within the past 5 years.

3.04 When so requested, Bidder shall meet with Owner's representatives and give further information in order to determine Bidder's qualifications, responsibility, ability to perform and complete the Work in accordance with the Contract Documents.

3.05 Owner reserves the right to reject any Bid if the evidence submitted by, or investigation of, a Bidder fails to satisfy Owner that the Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein.

ARTICLE 4 - EXAMINATION OF BIDDING DOCUMENTS, OTHER RELATED DATA, AND SITE

4.01 Subsurface and Physical Conditions

A. The supplementary Conditions identify:

1. None.

B. Copies of reports and drawings referenced in Paragraph 4.01.A will be made available by Owner to any Bidder on request at the cost of preparation, reproduction and shipping. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.03 of the General Conditions has been identified and established in Paragraph 5.03 of 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.

4.02 Underground Facilities

A. Information and data indicated in the Bidding Documents with respect to existing Underground Facilities at or contiguous to the Site are based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities, including Owner, or others.

4.03 Hazardous Environmental Condition

A. The Supplementary Conditions identify any reports and drawings known to Owner relating to a Hazardous Environmental Condition identified at the Site.

B. Copies of reports and drawings referenced in Paragraph 4.03 A. will be made available by Owner to any Bidder on request at the cost of preparation, reproduction and shipping. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in Paragraph 5.06 of the General Conditions has been identified and established in Paragraph 5.06 of 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.

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

4.05 On request, Owner will provide Bidder access to the Site to conduct such examinations, investigations, explorations, tests and studies as Bidder deems necessary for submission of a Bid. Bidder shall fill all holes, clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests and studies. Bidder shall comply with all applicable Laws and Regulations relative to excavation and utility locates.

4.06 Reference is made to the Supplementary Conditions and Division 01 Section "Summary of Work," for the identification of the general nature of other work that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) that relates to the Work contemplated by these Bidding Documents. On request, Owner will provide to each Bidder for examination access to or copies of contract documents, if any, (other than portions thereof related to price) for such other work.

4.07 Paragraph 7.13 C. of the General Conditions indicates that if an Owner safety program exists, it will be noted in the Supplementary Conditions.

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

A. examine and carefully study the Bidding Documents, and the other related data identified in the Bidding Documents;

B. visit the Site and become familiar with and satisfy Bidder as to the general, local and Site conditions that may affect cost, progress, and performance of the Work;

C. become familiar with and satisfy Bidder as to all federal, state and local Laws and Regulations that may affect cost, progress, or performance of the Work;

D. carefully study all: (1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) that have been identified in Paragraph 5.03 of the Supplementary Conditions as containing reliable "technical data," and (2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 4.06 of the Supplementary Conditions as containing reliable "technical data;"

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

F. agree at the time of submitting its Bid that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of its Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents;

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

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

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

4.09 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bidding Documents and applying any specific means, methods, techniques, sequences and procedures of construction that may be shown or indicated or expressly required by the Bidding Documents, that Bidder has given Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Bidding Documents and the written resolutions thereof by Engineer are acceptable to Bidder, and that the Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

ARTICLE 5 – PREBID CONFERENCE

5.01 A Prebid Conference will be held on April 30, 2025 at 10 a.m., local time at 1111 Allendale Ave, Owosso, MI 48867. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

ARTICLE 6 - SITE AND OTHER AREAS

6.01 The Site is identified in the Bidding Documents. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Bidding Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor.

ARTICLE 7 - INTERPRETATIONS AND ADDENDA

7.01 All questions about the meaning or intent of the Bidding Documents are to be directed to Engineer in writing. Interpretations or clarification considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than 7 days prior to the date for opening of Bids may not be answered. Only questions answered by Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

7.02 Addenda may be issued to clarify, correct, or change the Bidding Documents as deemed advisable by Owner or Engineer.

ARTICLE 8 - BID SECURITY

8.01 A Bid must be accompanied by an original Bid security (with affixed seal) made payable to Owner in an amount of 5% of Bidder's maximum Bid price and in the form of a certified check, bank money order, or a Bid bond (optional form attached) issued by a surety meeting the requirements of paragraphs 6.01 and 6.02 of the General Conditions. Facsimile, telegraphic, or other electronically transmitted Bid Security or Bid bonds submitted with the Bid will not be considered. Attorneys-in-fact who execute the Bid Security or Bid bond on behalf of the Surety shall affix to the bond a certified and current copy of the power of attorney.

8.02 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Contract Documents, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Contract Documents and furnish the required contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited. Such forfeiture shall be Owner's exclusive remedy if Bidder defaults. The Bid security of other Bidders whom 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 Agreement or 91 days after the Bid opening, whereupon Bid security furnished by such Bidders will be returned.

8.03 Bid security of other Bidders whom Owner believes do not have a reasonable chance of receiving the award will be returned within 7 days after the Bid opening.

ARTICLE 9 - CONTRACT TIMES

9.01 The dates by which the Work is to be substantially completed and ready for final payment are set forth in the Agreement.

ARTICLE 10 - LIQUIDATED DAMAGES

10.01 Provisions for liquidated damages, if any, are set forth in the Agreement.

ARTICLE 11 - SUBSTITUTE AND "OR EQUAL" ITEMS

11.01 The Contract, if awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration of possible substitute or "or equal" items.

11.02 Whenever materials or equipment are specified or described in the Bidding Documents by using the name of one or more Suppliers, the Bid shall be based on providing the materials or equipment of one of the Suppliers named.

11.03 Whenever it is specified or described in the Bidding Documents that a substitute or "or equal" item of material or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement. The procedure for submission of any such application by Contractor and consideration by Engineer is set forth in Paragraph 6.05 of the General Conditions and may be supplemented in Division 01 - General Requirements.

ARTICLE 12 - SUBCONTRACTORS, SUPPLIERS AND OTHERS

12.01 If the Supplementary Conditions require, or if Owner requests, the identity of certain Subcontractors, Suppliers, individuals, or entities to be submitted to Owner in advance of a specified date prior to the Effective Date of the Agreement, the apparent Successful Bidder, and any other Bidder so requested, shall within 5 days after Bid opening, submit to Owner a list of all such Subcontractors, Suppliers, individuals, or entities proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualifications for each such Subcontractor, Supplier, individual or entity if requested by Owner. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, individual, or entity, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case the apparent Successful Bidder shall submit an acceptable substitute, Bidder's Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.

12.02 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors, Suppliers, individuals, or entities. Declining to make requested substitutions will not constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor, Supplier, individual, or entity so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 7.07 of the General Conditions.

12.03 Contractor shall not be required to employ any Subcontractor, Supplier, individual, or entity against whom Contractor has reasonable objection except as identified in those Procurement Contracts, if any, which will be assigned to the Contractor and identified in the Bidding Documents.

ARTICLE 13 - PREPARATION OF BID

13.01 The Bid form is included with the Bidding Documents. Additional copies may be obtained from Engineer.

13.02 All blanks on the Bid form shall be completed by printing in ink or by typewriter and the Bid signed in ink. Erasures or alterations shall be initialed in ink by the person signing the Bid form. A Bid price shall be indicated for each listed therein. In the case of optional alternatives the words “No Bid”, “No Change”, or “Not Applicable” may be entered.

13.03 A Bid by a corporation shall be executed in the corporate name by the president, vice president, or other corporate officer accompanied by evidence of authority to sign. The corporate seal shall be affixed, if required by state law, and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be indicated below the signature.

13.04 A Bid by a partnership shall be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership shall be indicated below the signature.

13.05 A Bid by a limited liability company shall be executed in the name of the firm by a member and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm shall be indicated below the signature.

13.06 A Bid by an individual shall indicate the Bidder’s name and official address.

13.07 A Bid by a joint venture shall be executed by each joint venturer in the manner indicated on the Bid form. The official address of the joint venture shall be indicated below the signature.

13.08 All names shall be typed or printed in ink below the signatures.

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

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

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

ARTICLE 14 - BASIS OF BID; COMPARISON OF BIDS

14.01 Basis of Bid

A. Bidders shall submit a Bid on a stipulated (lump) sum basis for the base Bid as set forth in the Bid form.

14.02 The Bid price shall 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.

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

14.04 **No escalation will be accepted after the bid is submitted.**

ARTICLE 15 - SUBMITTAL OF BID

15.01 Blank copies of the Bid form and the Bid bond form are available online. (Go to www.fishbeck.com, click on "Bid Sets/Bidders Lists") The Bid form is to be completed and submitted with the Bid security.

15.02 With each copy of the Bidding Documents, a Bidder is furnished one separate unbound copy of the Bid form. The unbound copy of the Bid form is to be completed and submitted with the Bid security and the following data:

A. Evidence of authority to sign Bid, if Bid is submitted by a corporation, partnership or joint venture;

B. List of Proposed Subcontractors.

C. List of Proposed Suppliers for major equipment.

D. List of Project References.

E. Evidence of authority to do business in the state with the Project is located; or a written covenant to obtain such license prior to the award of the Contract.

F. Drinking Water State Revolving Fund Required Documents, including;

1. Executed American Iron and Steel compliance statement.

2. Certification Regarding Debarment Suspension.

3. Complete Good Faith Efforts Worksheet and required supporting documentation.

15.03 A Bid shall be submitted no later than the date and time prescribed and at the place indicated in the Advertisement for Bids and shall be enclosed in an opaque, sealed package, plainly marked with the Project title and name and address of the Bidder. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid shall be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED".

15.04 Bid forms with facsimile or other electronically transmitted signatures will not be considered.

ARTICLE 16 - MODIFICATION AND WITHDRAWAL OF BIDS

16.01 A Bid may be modified or withdrawn by an appropriate document duly executed in the 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.

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

16.03 No withdrawal of a Bid shall be permitted on account of mistake or any other reason after the expiration of this 24 hour period.

ARTICLE 17 - OPENING OF BIDS

17.01 Bids will be opened at the time and place indicated in the Advertisement for Bids and, unless obviously nonresponsive, read aloud publicly. An abstract of the amounts of the Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.

ARTICLE 18 - BIDS TO REMAIN SUBJECT TO ACCEPTANCE

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

ARTICLE 19 - AWARD OF CONTRACT

19.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced or conditional Bids. Owner further reserves the right to reject the Bid of any Bidder whom it finds, after reasonable inquiry and evaluation, to not be responsible. Owner may also reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder. Owner also reserves the right to waive all informalities not involving price, time or changes in the Work and to negotiate contract terms with the Successful Bidder.

19.02 More than one Bid for the same Work from an individual or entity under the same or different names will not be considered. Reasonable grounds for believing that any Bidder has an interest in more than one Bid for the Work may be cause for disqualification of that Bidder and the rejection of all Bids in which that Bidder has an interest.

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

19.04 In evaluating Bidders, Owner will consider the qualifications of Bidders and may consider the qualifications and experience of Subcontractors, Suppliers and other individuals or entities proposed for those portions of the Work for which the identity of Subcontractors, Suppliers, and other individuals or entities must be submitted as provided in the Supplementary Conditions.

19.05 Owner also may consider the operating costs, maintenance considerations, performance data and guarantees of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

19.06 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers, individuals or entities proposed for those portions of the Work in accordance with the Contract Documents.

19.07 If the Contract is to be awarded, Owner will award the Contract to the Bidder whose Bid is in the best interests of the Project.

19.08 If the Contract is to be awarded, Owner will give Successful Bidder a Notice of Award within 120 days after the day of the Bid opening. If Owner does not issue the Notice of Award within 21 days after the day of the Bid opening, the dates for Substantial Completion and final completion will each be extended by one day for each day that the Notice of Award date exceeds the 21 days.

ARTICLE 20 - CONTRACT SECURITY AND INSURANCE

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

20.02 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to bonds. When Successful Bidder delivers the executed Agreement to Owner, it shall be accompanied by the required bonds.

ARTICLE 21 - SIGNING OF AGREEMENT

21.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement bound into the Project Manual with the other Contract Documents which are identified in the Agreement as attached thereto. Within 15 days thereafter, Successful Bidder shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner. Within 10 days thereafter, Owner will deliver one fully signed counterpart to Successful Bidder.

ARTICLE 22 - RETAINAGE AND PROGRESS PAYMENTS

22.01 Provisions concerning retainage and progress payments are set forth in the Agreement.

22.02 Retainages and progress payments will be in accordance with State of Michigan Act 524 of the Public Acts of 1980.

END OF SECTION 00 21 13

SECTION 00 31 32 – GEOTECHNICAL DATA

Beginning of Geotechnical Data

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April 4, 2025
Project No. 251023Rev1

Fishbeck
1515 Arboretum Drive SE
Grand Rapids, Michigan 49546

Attention: Brian Van Zee

Reference: Revised Report of Geotechnical Investigation
Owosso Well House Improvements
Owosso, Michigan

Dear Mr. Van Zee:

Materials Testing Consultants, Inc. has completed a geotechnical investigation for the above-referenced project. The findings of the study along with recommendations for the design of foundations are presented in the attached revised report which supersedes our original geotechnical report dated January 30, 2025, and includes name updates to the referenced well houses.

We appreciate this opportunity to provide foundation engineering services and express our interest in providing continuing services in the areas of subgrade verification, special inspections and quality testing on various construction materials. Please contact our office should you have any questions or require further assistance.

Sincerely,

MATERIALS TESTING CONSULTANTS, INC.

Elise R. Spohn, E.I.T.
Senior Staff Engineer

Jonathan E. O'Brock, P.E.
Project Manager

att: Revised Report

MATERIALS TESTING CONSULTANTS

REVISED GEOTECHNICAL REPORT

OWOSSO WELL HOUSE IMPROVEMENTS
OWOSSO, MICHIGAN

Prepared For:

FISHBECK
Grand Rapids, Michigan

Prepared By:

MATERIALS TESTING CONSULTANTS, INC.

April 2025
MTC Project No. 251023Rev1

TABLE OF CONTENTS

REVISED REPORT OF GEOTECHNICAL INVESTIGATION
OWOSSO WELL HOUSE IMPROVEMENTS

1.0 INTRODUCTION

MATERIALS TESTING CONSULTANTS, INC. (MTC) has completed a geotechnical investigation for the proposed well house improvements, located in Owosso, Michigan. This work has been performed as described in our proposal, number 18966 and dated December 26, 2024. Authorization to proceed was received from Mr. Brian Van Zee with Fishbeck via email on January 3, 2025. The scope of this study was described in an RFP letter received via email on December 19, 2024. This revised report supersedes our geotechnical report dated January 30, 2025, and includes name updates to the referenced well houses.

The scope of this study in general includes the following:

- performance of a field investigation including soil test borings and field engineering reconnaissance;
- review of recovered samples by one of our engineers and assignment of technical soil classifications;
- engineering evaluation of encountered conditions with respect to the proposed construction; and
- preparation of this report.

Presented herein are descriptions of our understanding of the design considerations, the investigation program, encountered conditions and engineering recommendations. The Appendix contains the report limitations, boring log terminology, soil classification chart, and boring logs.

2.0 DESIGN CONSIDERATIONS

2.1 Available Information

We have been provided the following documents and information for use in this investigation:

- Location plans (2 aerial images) with the requested boring locations provided via email by Mr. Brian Van Zee with Fishbeck on January 6, 2025.
- Telephone conversations and email correspondence with Mr. Brian Van Zee and Ms. Meghana Kamath with Fishbeck regarding the type of construction, design loads, elevations, and well house names.

2.2 Location and Type of Structure

The proposed construction will be located in plan as shown on the attached Boring Location Plans, Figures No. 1 to 2. The areas of investigation were adjacent to existing well houses LW1 and PW2 near Allendale Avenue and Palmer Street in Owosso, Michigan.

We understand that the construction will include the demolition of the existing slab-on-grade well house LW1 and PW2 structures which are over existing wells at the above-described locations and replacement with single-story structures of approximately the same size as the existing structures and at approximately the same locations. We anticipate that the lowest finish floors will match that of the existing structures with little to no exterior modification. Although we have not been provided the anticipated design loads, we have considered maximum column loads of 10 kips (if present) and maximum wall loads of 4 kips per lineal foot.

We should be informed of any changes between the actual design conditions and those described herein as this information may affect our recommendations.

3.0 INVESTIGATION METHODOLOGY

3.1 Field Investigation

Subsurface conditions were investigated by two (2) conventional soil test borings, each adjacent to well houses LW1 and PW2. Boring depths reached 15 ft below the existing ground surface. Boring locations are shown on the attached plans, Figures No. 1 to 2.

One of our geologists staked the approximate boring locations in the field. Boring elevations were visually approximated using the first-floor elevations (FFE) of the existing well house LW1 and PW2 structures as reference. If more precise location and elevation data are desired, a registered professional land surveyor should be retained to locate the borings and determine their ground elevations.

The drilling was performed using conventional hollow-stem auger methods to advance the borehole. The boreholes were backfilled to the original ground surface with compacted cuttings and bentonite hole-plug after drilling completion.

Soil samples were recovered on regular intervals by means of the Standard Penetration Test (SPT), ASTM D1586. The SPT test involves the use of a 140-lb hammer with a 30-inch drop to drive a standard 2.0-inch O.D. split spoon sampler. The number of hammer blows required to drive the sampler 12 inches, after seating 6 inches, is termed the soil N-value and provides an indication of the soil's relative density and strength parameters at the sample location. SPT blow counts in 6-inch increments are recorded on the boring logs. The drill rig was equipped with an automatic hammer system which delivers a more consistent driving energy to the sampler compared to the rope and cathead system.

Recovered samples were sealed, labeled and transported to our laboratory. All soil samples will be discarded after sixty days unless a longer hold time is specifically requested.

The recovered soil samples were reviewed by an engineer and technically classified according to the methods of ASTM D2488 "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)". Estimates of the unconfined compressive strength of the cohesive samples were made using a calibrated penetrometer. A copy of the boring logs along

with a description of the terminology used on the logs and a chart of the ASTM D2488 group symbol names are provided in the Appendix.

Borings were drilled and other sampling was conducted solely to obtain indications of subsurface conditions as part of a geotechnical exploration program. No services were performed to evaluate subsurface environmental conditions.

4.0 INVESTIGATION RESULTS

4.1 Regional Geology

The *Map of the Surface Formations of the Southern Peninsula of Michigan*, published by the State of Michigan, indicates the site is in an area of sand lakebeds and moraines. Soil conditions typically are found to be primarily granular soil in sand lakebeds and a mixture of granular and cohesive soil in moraines. The *Map of Bedrock Topography of the Southern Peninsula of Michigan* indicates bedrock to be at approximately el 650 to 700.

4.2 Site Conditions

Allendale Avenue Well House (LW1)

At the time of our field work, the area of investigation near the existing well house LW1 was a snow-covered lawn. The existing structure contains a well with associated piping extending southwest from the southwest edge of the structure as well as a discharge line extending north from the north edge of the structure. There were no obvious signs of structural distress, such as readily-visible settlement or cracking, on the exterior of the existing structure, which appears to be of metal sheeting construction on the exterior.

The site is located northeast of the existing Owosso City Office and Wastewater Treatment Plant (WWTP). Several ponds, which appear to be man-made and associated with the WWTP, are located north of the existing structure. The Shiawassee River borders the north edge of the site, and the river shorelines are approximately 450 ft east, 1,000 ft north, and 700 ft west of the existing structure. We understand the 100-year base flood elevation (BFE) for the

adjacent Shiawassee River corresponds to el 732 based on available FEMA flood maps. Based on available USGS topographic maps, the ground surface near well house LW1 appeared to be approximately el 735.

Photograph 1 – Allendale Avenue Well House (LW1), Looking East

Palmer Street Well House (PW2)

At the time of our field work, the area of investigation near the existing well house PW2 was a snow-covered lawn. The existing structure contains a well with associated piping extending east from the east edge of the structure. There were no obvious signs of structural distress, such as readily-visible settlement or cracking, on the exterior of the existing structure, which appears to be of metal sheeting construction on the exterior.

The shoreline of Hopkins Lake was observed to be approximately 30 ft west of the existing structure. Based on available USGS topographic maps, the ground surface near well house PW2 appeared to be approximately el 767.

Photograph 2 – Palmer Street Well House (PW2), Looking West

4.3 Subsurface Conditions

Allendale Avenue Well House (LW1), B-1

The investigation encountered 6 inches of topsoil at the ground surface underlain by loose silty sand (SM) and very stiff lean clay (CL) to depths of 2.5 ft and 5.5 ft, respectively. Beneath the cohesive soil, medium dense poorly graded sand (SP) was encountered to the explored depth of 15 ft. Groundwater was encountered during the drilling activities at a depth of 9.5 ft below the ground surface.

Palmer Street Well House (PW2), B-2

The investigation encountered 7 inches of topsoil at the ground surface underlain by medium dense silty sand (SM) and loose poorly graded sand (SP) to depths of 2.5 ft and 5.5 ft, respectively. Beneath the granular soil, stiff to very stiff lean clay (CL) was encountered to the explored depth of 15 ft. Groundwater was not encountered during the drilling activities.

The relative density of granular soil is based on recorded SPT N-values while the consistency of cohesive soil is based on estimates of the unconfined compressive strength obtained with a calibrated penetrometer.

Groundwater levels may fluctuate due to seasonal variations such as precipitation, snowmelt, nearby river or lake levels and other factors that may not be evident at the time of measurement. Groundwater levels may be different at the time of construction.

This section has provided a generalized description of the encountered subsurface soil conditions. The boring logs located in the Appendix should be reviewed for detailed soil descriptions. Some variation between boring locations may be expected.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Foundations

A conventional shallow continuous and spread foundation system is recommended for support of the proposed well house structures. It is important that the recommendations of this report, in particular those pertaining to subgrade preparation, construction observation and testing, be implemented during design and construction.

The following parameters are recommended for foundation design at both the Allendale Avenue (LW1) and Palmer Street (PW2) well house locations:

Table 5.1.1 - Foundation Design Parameters

Bearing pressure for square or rectangular foundations, maximum net allowable, psf	2000
Bearing pressure for continuous foundations, maximum net allowable, psf	2000
Minimum width of square or rectangular foundations, inches	24
Minimum width of continuous foundations, inches	18
Minimum embedment depth for frost protection, inches	42

Foundations are expected to bear on the very stiff lean clay (CL) and loose poorly graded sand (SP) as encountered in Borings B-1 and B-2, respectively, or on approved engineered fill. Subgrade preparation recommendations are contained in the following section.

Foundation recommendations presented herein are based on a safety factor to resist bearing capacity failure of at least 3.0 and a maximum anticipated total foundation settlement of 1 inch or less.

5.2 Site and Subgrade Preparation

All topsoil, vegetation, roots and any other miscellaneous debris should be removed from within the proposed construction areas. The limits of the proposed construction area, prior to the placement of any structures or engineered fill material, should be proof-rolled and compacted in the upper 12 inches using suitable compaction equipment to at least 95 percent of the soil's maximum ASTM D1557 dry density by the Contractor. Proof-rolling is defined as the passing of relatively heavy construction equipment over the soil subgrade under observation by the Geotechnical Engineer. The response of the soil, when subjected to the applied load, is subjectively evaluated by qualified geotechnical personnel with respect to its ability to support the overlying soil or structure. In areas where excessive deflection is observed, special subgrade preparation measures may be recommended to provide an acceptable subgrade condition. These measures may consist of compaction of the subgrade at moisture contents close to the optimum value, undercutting affected areas and replacing with engineered fill, use of a geotextile separation fabric or some combination of these measures.

Due to the existing wells and associated piping at well houses LW1 and PW2 and due to variations that may exist between borings, it is possible that some form of subgrade improvement may be required to provide suitable foundation bearing conditions. Subgrade improvement may include, but not be necessarily limited to, densification of existing soil in-place or excavation of all unsuitable material to an approved subgrade and replacement with engineered fill. If overexcavation is selected, it should encompass soil within the stress influence region of the foundation, defined as a region bordered by 2V:1H planes extending down and away from the bottom edge of the foundation to the approved bearing stratum.

The foundation subgrade should be inspected and tested by qualified geotechnical personnel. As part of the inspection and testing, the subgrade at each individual bearing element should be verified to be consistent with the conditions encountered in this investigation and the indicated recommended allowable bearing pressures. This testing should include the

verification of acceptable unconfined compressive strengths in cohesive soil and a dynamic cone penetrometer (ASTM STP399) to verify minimum relative densities and equivalent N-values in granular soil. Care should be taken to maintain the natural moisture content of clayey subgrade soil which may become soft when saturated from rainfall, etc.

Engineered fill is approved on-site or imported soil placed in uniform layers and compacted to a minimum required density. Generally, on-site soil with group symbols of SP are expected to be suitable for engineered fill. Imported engineered fill should meet the requirements for MDOT Class II granular material. MDOT Class II soil or approved on-site soil meeting the requirements of SP should be used as backfill against below-grade walls and foundations.

Granular engineered fill and backfill should be compacted to at least 95 percent of the soil's maximum dry density as determined by the Modified Proctor test (ASTM D1557). Vibratory compaction methods are typically found to be most effective in granular soils; however, relatively light equipment should be used adjacent to retaining or basement walls to avoid overstressing the walls.

The fill should be placed and compacted in horizontal layers not exceeding 9 inches. Field density tests should be taken on each lift, as the fill is being placed, to verify compliance with compaction specifications.

If the earthwork takes place during winter months, fill must not be placed on frozen ground and fill with frozen conglomerations of soil must not be used.

Because the site has been previously developed, there may be buried items not encountered in our borings, such as a septic tank, well, or utility conduit, which may cause settlement problems. The contract documents should reflect that it is necessary to remove or relocate such structures and to fill the excavation with engineered fill.

5.3 Groundwater

Groundwater was generally encountered in Boring B-1 located near well house LW1 at a depth of 9.5 ft, below the anticipated depth of excavation for foundation construction and site preparation. Groundwater may be encountered during construction and suitable control of

groundwater should be anticipated and planned for accordingly before the start of construction. The Contractor should be responsible for selecting and implementing an appropriate groundwater control system. The Contractor should have previous dewatering experience on sites with similar conditions. Suitable silt and sediment traps should be incorporated into the dewatering system.

To prevent the accumulation of water and resulting hydrostatic pressure along below-grade walls, a footing drain should be included in the design. A perimeter footing drain is recommended in all areas where the building's floor slab is at or below the adjacent exterior elevation. Dampproofing or waterproofing, in accordance with the applicable building code requirements, of the below-grade slabs and walls should be provided.

5.4 Slopes and Temporary Excavations

The Owner and the Contractor should make themselves aware of and become familiar with applicable local, state, and federal safety regulations, including current OSHA excavation and trench safety standards. Construction site safety generally is the sole responsibility of the Contractor. The Contractor shall also be solely responsible for the means, methods, techniques, sequences and operations of construction operations. We are providing the following information solely as a service on this project and, under no circumstances, should our provision of the following information be construed to mean that we are assuming responsibility for construction site safety or the Contractor's activities; such responsibility is not implied and should not be inferred.

The Contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, or federal safety regulations; e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations. For both sites, the overburden soil encountered in our exploratory program is granular. We anticipate that OSHA will classify these materials as Type C. OSHA recommends a maximum slope inclination of 1½H:1V for this type of soil under ideal conditions.

5.5 Concrete Floor Slabs

Subgrade preparation in floor slab areas should be as described in the "Site and Subgrade Preparation" section of this report. For design of the concrete floor slabs supported on-grade, a modulus of subgrade reaction value, $K_{30,}$ of 100 psi/inch is recommended. We recommend placement of at least 4 inches of MDOT Class II fill directly beneath the floor slab. Design of concrete slabs should be in accord with ACI and the applicable building code recognized design guidelines. If a vapor sensitive covering will be placed over the floor slab or the slab will be in a humidity-controlled area, a vapor retarder/barrier is recommended following ACI 302.1R-15 guidelines and the floor covering manufacturer's guidelines.

5.6 MBC Seismic Considerations

The seismic design category can be determined with noted exceptions following Section 1613 of the 2015 Michigan Building Code. The Risk Category under Section 1613.3.5 shall be determined by a licensed structural engineer. Based on the subsurface conditions identified in the soil borings, our experience with the geological conditions in the site vicinity and the procedures outlined in Section 1613 of the 2015 Michigan Building Code and Chapter 20, Table 20.3-1 of ASCE 7, we recommend assigning a Site Class D to this site. A Site Class D designates a stiff soil profile in the upper 100 ft with average SPT uncorrected N-values between 15 and 50 in granular soil and average undrained shear strengths, s_u, between 1,000 and 2,000 psf in cohesive soil. Recommended seismic ground motion values are provided in Table 5.6.1.

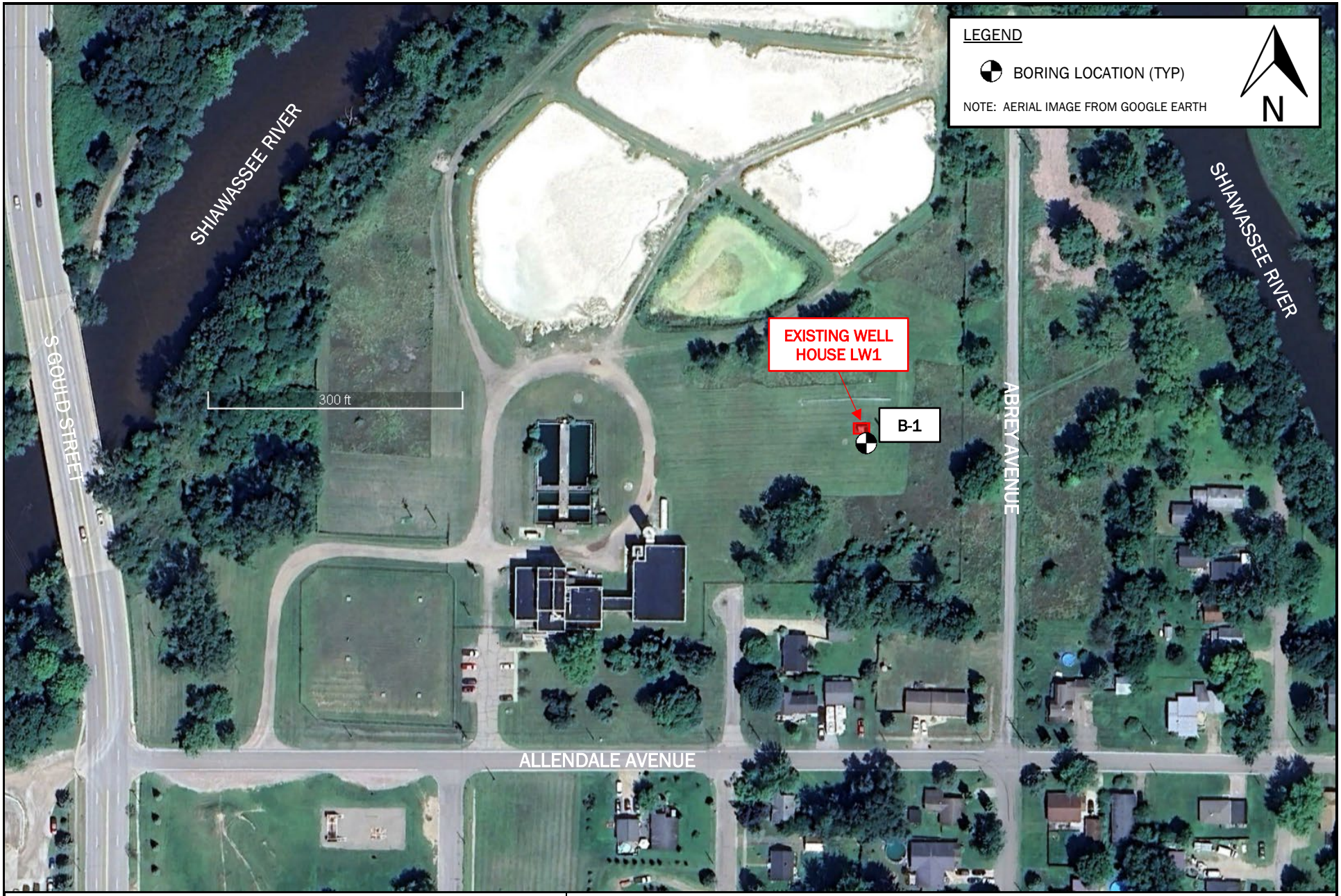
Table 5.6.1 - Recommended Seismic Ground Motion Values

2015 Michigan Building Code Values	Short Period (0.2 sec)	Long Period (1 sec)
Spectral Response Acceleration, Figure 1613.3.1 (1 and 2), %g	S_s = 8	S_1 = 5
Seismic Site Coefficient, Table 1613.3.3 (1 and 2)	F_a = 1.6	F_v = 2.4
Maximum Considered Spectral Response Acceleration, Equations 16-37 and 16-38	S_{MS} = 0.128g	S_{M1} = 0.120g
5% Damped Spectral Response Acceleration, Equations 16-39 and 16-40	S_{DS} = 0.085g	S_{D1} = 0.080g

6.0 CLOSURE

In this report, descriptions of the geotechnical investigation, encountered conditions and recommendations for the design of foundations have been provided. The limitations of this study are described in the Appendix.

The recommendations presented in this report are based upon a limited number of subsurface samples obtained from various sampling locations. The samples may not fully indicate the nature and extent of the variations that actually exist between sampling locations. For that reason, among others, we strongly recommend that a qualified geotechnical firm be retained to observe earthwork construction. If variations or other latent conditions become evident during construction, it will be necessary for us to review these conditions and our recommendations as appropriate.



TITLE: BORING LOCATION PLAN – ALLENDALE AVENUE WELL HOUSE		PROJECT: OWOSSO WELL HOUSE IMPROVEMENTS	
SCALE: AS SHOWN	DATE: JANUARY 29, 2025	PROJECT NO.: 251023	MTC MATERIALS TESTING CONSULTANTS
FIG. NO.: 1	DR. BY: ES	REV. BY: JO	

TITLE: BORING LOCATION PLAN – PALMER STREET WELL HOUSE		PROJECT: OWOSSO WELL HOUSE IMPROVEMENTS	
SCALE: AS SHOWN	DATE: APRIL 4, 2025	PROJECT NO.: 251023	MTC MATERIALS TESTING CONSULTANTS
FIG. NO.: 2	DR. BY: ES	REV. BY: JO	

APPENDIX

- Limitations
- Test Drilling and Sampling Procedures
- Boring Log Terminology and Classification Outline
- Boring Logs

LIMITATIONS

Soil Variations

The recommendations in this report are based upon the data obtained from the soil borings. This report does not reflect variations which may occur between these borings, and which would not become evident until construction. If variations then become evident, it would be necessary for a re-evaluation of recommendations of this report, after performing on-site observations.

Warranties

We have prepared this report in accordance with generally accepted soil and foundation engineering practices. We make no other warranties, either expressed or implied, as to the professional advice provided under the terms of our agreement and included in this report. This report is prepared exclusively for our client and may not be relied upon by other parties without written consent from our office.

Boring Logs

In the process of obtaining and testing samples and preparing this report, we follow reasonable and accepted practice in the field of soil engineering. Field logs maintained during drilling describe field occurrences, sampling locations, and other information. The samples obtained in the field are subjected to additional testing in the laboratory and differences may exist between the field logs and the final logs. The engineer reviews the field logs and laboratory test data, and then prepares the final boring logs. Our recommendations are based on the contents of the final logs.

Review of Design Plans and Specifications

In the event that any changes in the design of the building or the location, however slight, are planned, our recommendations shall not be considered valid unless modified or approved in writing by our office. We recommend that we be provided the opportunity to review the final design and specifications in order to determine whether changes in the original concept may have affected the validity of our recommendations, and whether our recommendations have, in fact, been implemented in the design and specifications.

TEST DRILLING AND SAMPLING PROCEDURES

Test Drilling Methods:

- [X] Hollow stem auger, ASTM D6151
- [ ] Mud rotary, ASTM D5783
- [ ] Casing advancer, ASTM D5872
- [ ] Rock coring, ASTM D2113
- [ ] Core/Hand Auger

Note: Cone penetration test data can be used to interpret subsurface stratigraphy and can provide data on engineering properties of soils. The ASTM procedure does not include a procedure for determining soil classification from CPT testing. Soil classifications shown on CPT logs are based on published procedures and are not based on physical ASTM soil classification tests.

Sampling Methods:

- [X] SPT, ASTM D1586, Auto hammer (140 lb., 30" drop, 2" OD split spoon sampler)
- [ ] Thin-walled tube sampler (Shelby), ASTM D1587

Note: The number of hammer blows required to drive the SPT sampler 12 inches, after seating 6 inches, is termed the soil N-value and provides an indication of the soil's relative density and strength parameters at the sample location. SPT blow counts in 6 inch increments are recorded on the boring logs.

Drill Rig:

- [X] CME 55 (ATV)
- [ ] Acker Renegade (ATV)
- [ ] CME 45 Truck
- [ ] Geoprobe 7822 (ATV)
- [ ] Geoprobe Rotary Sonic

Boreholes Backfilled With:

- [X] Excavated soil
- [ ] Cement bentonite grout
- [ ] Piezometer or Monitoring Well (see notes on logs)
- [ ] Concrete or asphalt patch where appropriate
- [X] Bentonite hole-plug

Sample Handling and Disposition:

- [X] Samples labeled, placed in jars, returned to MTC Laboratory
- [X] Discard after 60 days

BORING LOG TERMINOLOGY AND ASTM D 2488 CLASSIFICATION OUTLINE

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE-GRAINED SOILS (major portions retained on No. 200 sieve): includes (1) clean gravel and sands and (2) silty or clayey gravels and sands. Condition is rated according to relative density as determined by laboratory tests or standard penetration resistance tests.

Descriptive Terms	Relative Density	SPT Blow Count
Very loose	0 to 15 %	< 5
Loose	15 to 35 %	5 to 10
Medium dense	35 to 65 %	10 to 30
Dense	65 to 85 %	30 to 50
Very dense	85 to 100 %	> 50

Per ASTM D2487, the following conditions must be met based on laboratory testing to justify the label 'well graded' in a soil description.

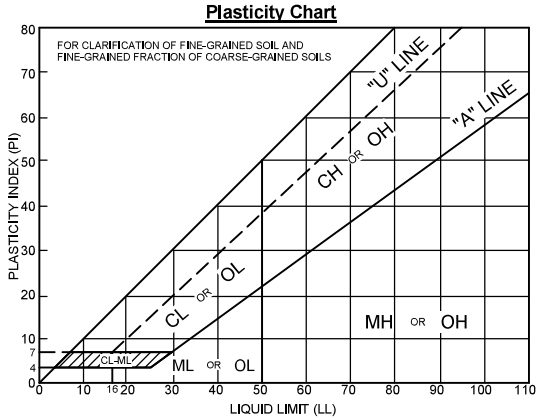
Gravel: $C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3

Sand: $C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3

FINE-GRAINED SOILS (major portions passing on No. 200 sieve): includes (1) inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings, SPT blow count, or unconfined compression tests.

Descriptive Terms	Unconfined Compressive Strength TSF	SPT Blow Count
Very soft	< 0.25	< 2
Soft	0.25 to 0.5	2 to 4
Medium stiff	0.5 to 1.0	4 to 8
Stiff	1.0 to 2.0	8 to 15
Very stiff	2.0 to 4.0	15 to 30
Hard	> 4.0	> 30

Plasticity Chart



MAJOR DIVISIONS					TYPICAL NAMES
COARSE-GRAINED SOILS MORE THAN HALF IS COARSER THAN NO. 200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LESS THAN 15% FINES	GW		WELL-GRADED GRAVELS WITH OR WITHOUT SAND
			GP		POORLY-GRADED GRAVELS WITH OR WITHOUT SAND
		GRAVELS WITH 15% OR MORE FINES	GM		SILTY GRAVELS WITH OR WITHOUT SAND
			GC		CLAYEY GRAVELS WITH OR WITHOUT SAND
	SANDS MORE THAN HALF COARSE FRACTION IS FINER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 15% FINES	SW		WELL-GRADED SANDS WITH OR WITHOUT GRAVEL
			SP		POORLY-GRADED SANDS WITH OR WITHOUT GRAVEL
			SP-SM		POORLY-GRADED SANDS WITH SILT WITH OR WITHOUT GRAVEL
		SANDS WITH 15% OR MORE FINES	SM		SILTY SANDS WITH OR WITHOUT GRAVEL
			SC		CLAYEY SANDS WITH OR WITHOUT GRAVEL
FINE-GRAINED SOILS MORE THAN HALF IS FINER THAN NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50% OR LESS		ML		INORGANIC SILTS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			OL		ORGANIC SILTS OR CLAYS OF LOW TO MEDIUM PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50%		MH		INORGANIC SILTS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			CH		INORGANIC CLAYS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
			OH		ORGANIC SILTS OR CLAYS OF HIGH PLASTICITY WITH OR WITHOUT SAND OR GRAVEL
HIGHLY ORGANIC SOILS			PT/OL		PEAT AND OTHER HIGHLY ORGANIC SOILS

GENERAL NOTES

1. Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
2. "Grades with" or "Grades without" may be used to describe soil when characteristics vary within a stratum.
3. Preserved soil samples will be discarded after 60 days unless alternate arrangements have been made.

GROUNDWATER OBSERVATIONS:

During - indicates water level encountered during the boring
End- indicates water level immediately after drilling
Date and Depth - Measurements at indicated date

SAMPLE TYPES AND NUMBERING

S	SPT, split barrel sample, ASTM D1586
U	Shelby tube sample, ASTM D1587
R	Rock core run
*S	Other than 2" split barrel sample
L	SPT with liner, ASTM D1586
A	Auger cuttings
G	Geoprobe liner

MINOR COMPONENT QUANTIFYING TERMS

Less than 5%	TRACE
5 to 10%	FEW
15 to 25%	LITTLE
30 to 40%	SOME
50 to 100%	MOSTLY

GRAIN SIZE

BOULDER	>12"
COBBLE	12" to 3"
COARSE GRAVEL	3" to 0.75"
FINE GRAVEL	0.75" to No. 4
COARSE SAND	No. 4 to No. 10
MEDIUM SAND	No. 10 to No.40
FINE SAND	No. 40 to No. 200

LOG OF BORING

Project No.: 251023
Boring No.: B-1
Sheet: 1 of 1

Project: Owosso Well House Improvements
Client: Fishbeck
Location: Owosso, Michigan
Drill Type: CME 55
Crew Chief: GS Field Eng.: MM Rev. By: ES
Coordinates:
Elevation: 99.5 ft Datum: Existing Well House FF=100.0
Notes: B-1 was located approx. 7' north of Well House LW1. Ground surface elevation estimated based on visual approximation.
Plugging Record: Backfilled borehole with compacted cuttings and bentonite hole-plug. Cave in at 8.0 ft.

Date Begin: 01/17/2025 Date End: 01/17/2025

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	4 1/4"	During	9.5
Sampler	SPT	2"	End	8
Core			Delayed Groundwater, ft.	
Tube			Date	Depth, ft.
SPT Hammer	Auto			

Depth Drilled: 15.0 ft.

Component Percentages: Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%
QP = Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTM D 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	DD pcf	REMARKS
99.0	0.5					6" Silty Topsoil 0.5				
98.5	1.0	S-1	1.3	4-5-5 N=10	SM	Brown silty SAND; mostly fine sand, little silty fines, moist				
98.0	1.5									
97.5	2.0									
97.0	2.5					2.5				
96.5	3.0				CL	Gray lean CLAY; mostly clayey fines, few fine gravel, moist with occasional fine root fragments				
96.0	3.5									
95.5	4.0									
95.0	4.5	S-2	1.5	6-11-11 N=22			4.0			
94.5	5.0									
94.0	5.5									
93.5	6.0					6.0				
93.0	6.5				SP	Brown poorly graded SAND; mostly coarse to medium sand, trace fine gravel, moist				
92.5	7.0	S-3	1.5	5-13-15 N=28						
92.0	7.5									
91.5	8.0									
91.0	8.5									
90.5	9.0									
90.0	9.5	S-4	1.3	9-14-13 N=27						
89.5	10.0					Grades wet				
89.0	10.5									Charged augers with water at 10'
88.5	11.0									
88.0	11.5									
87.5	12.0									
87.0	12.5									
86.5	13.0									
86.0	13.5									
85.5	14.0									
85.0	14.5	S-5	1.2	7-8-21 N=29						S-5: Poor recovery; possible coarse gravel / COBBLE
84.5	15.0					15.0				
						End of Boring				

* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.

LOG OF BORING

Project No.: 251023
Boring No.: B-2
Sheet: 1 of 1

Project: Owosso Well House Improvements
Client: Fishbeck
Location: Owosso, Michigan
Drill Type: CME 55
Crew Chief: GS Field Eng.: MM Rev. By: ES
Coordinates:
Elevation: 98.5 ft Datum: Existing Well House FF=100.0
Notes: B-2 was located approx. 5' south of Well House PW2. Ground surface elevation estimated based on visual approximation.
Plugging Record: Backfilled borehole with compacted cuttings and bentonite hole-plug. Cave in at 11.5 ft.

Date Begin: 01/17/2025 Date End: 01/17/2025

Tooling	Type	Dia.	Groundwater, ft.	
Casing	HSA	4 1/4"	During	None
Sampler	SPT	2"	End	NA
Core			Delayed Groundwater, ft.	
Tube			Date	Depth, ft.
SPT Hammer	Auto			

Depth Drilled: 15.0 ft.

Component Percentages: Trace < 5%, Few 5-10%, Little 15-25%, Some 30-45%, Mostly 50-100%
QP = Calibrated Penetrometer (tons/sq. ft.)

Elev. FT.	Depth FT.	Sample Number	Recov. FT.	Penetration (Blows Per 6") ASTM D 1586	*USCS Group Symbol	*DESCRIPTION	QP tsf	MST %	DD pcf	REMARKS
98.0	0.5					7" Silty Topsoil 0.6				
97.5	1.0	S-1	1.5	14-6-5 N=11	SM	Brown silty SAND; mostly fine sand, little silty fines, moist				
97.0	1.5									
96.5	2.0									
96.0	2.5					2.5				
95.5	3.0					Brown poorly graded SAND; mostly fine sand, trace silty fines, moist				
95.0	3.5									
94.5	4.0									
94.0	4.5	S-2	1.5	9-5-3 N=8	SP					
93.5	5.0									
93.0	5.5									
92.5	6.0					6.0				
92.0	6.5					Gray lean CLAY; mostly clayey fines, trace fine gravel, moist				
91.5	7.0	S-3	1.5	WOH/12"-2			3.5			WOH = Weight of Hammer
91.0	7.5									
90.5	8.0									
90.0	8.5									
89.5	9.0									
89.0	9.5	S-4	1.5	5-6-6 N=12			2.0			
88.5	10.0									
88.0	10.5				CL					
87.5	11.0									
87.0	11.5									
86.5	12.0									
86.0	12.5									
85.5	13.0									
85.0	13.5									
84.5	14.0									
84.0	14.5	S-5	1.5	2-3-5 N=8			1.0			
83.5	15.0					15.0				
						End of Boring				

* Visual estimate following ASTM D 2488 unless laboratory testing has been performed. Stratification changes are approximated between samples.

END OF SECTION 00 31 32

SECTION 00 31 35 - WELL LOG DATA

Beginning of Well Log Data

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Job No. _____

Pipe extends 2+ feet above ground level.

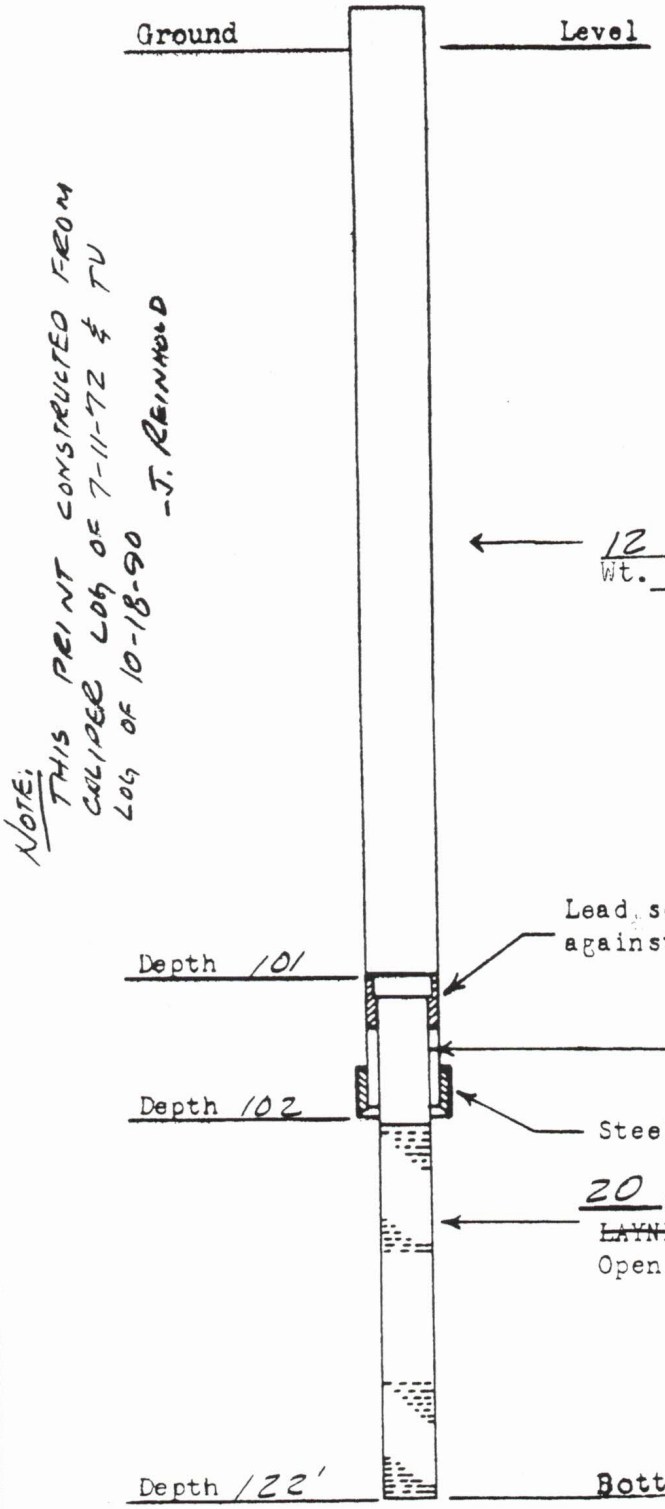
Location from Street or Road

POLMER STREET WELL FIELD

County _____

Township _____

Section _____



Pipe Tally	Welded Threaded
Bottom	
Top	
Total	

Static Level _____

Pumped _____ GPM

at _____ pumping level

after _____ hours

Driller _____

Date Finished _____

Not drawn to scale
All depths measured from Ground Level

LAYNE TUBULAR WELL No. PALMER 1

For

CITY OF OWOSSO, MICHIGAN

LAYNE NORTHERN CO. INC.

MISHAWAKA, INDIANA

DRAWN BY	DRAWING NO.
APPROVED BY	
DATE	

Pipe extends 2± feet above ground level.

Job No. _____

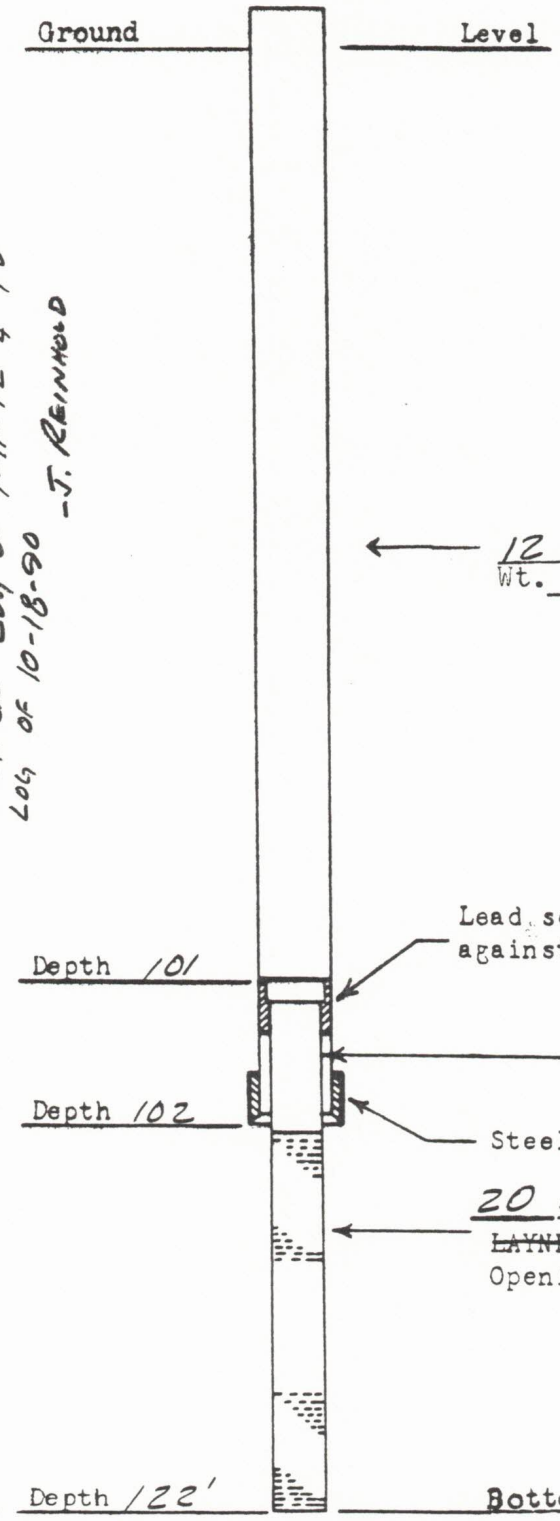
Location from Street or Road

PALMER STREET WELL FIELD

County _____

Township _____

Section _____



NOTE: THIS PRINT CONSTRUCTED FROM CALIPER LOG OF 7-11-72 & TV LOG OF 10-18-90 -J. REINHOLD

← 12 " Black Steel Pipe
Wt. ? lbs. per Foot

Lead seal expanded against pipe

Blank Tube

Steel Drive Shoe. UNKNOWN

20 ft. of WW
~~LAYNE~~ _____ Screen
Opening _____

Pipe Tally	Welded Threaded
Bottom	
Top	
Total	

Static Level _____

Pumped _____ GPM

at _____ pumping level

after _____ hours

Driller _____

Date Finished _____

Not drawn to scale
All depths measured from Ground Level

LAYNE TUBULAR WELL No. PALMER 1

For

CITY OF OWOSSO, MICHIGAN

LAYNE NORTHERN CO. INC.
MISHAWAKA, INDIANA

DRAWN BY	DRAWING NO.
APPROVED BY	
DATE NOV. 20, 1990	

LAYNE-NORTHERN COMPANY, INC.
Mishawaka, Indiana

Date 5/7/ 19 68

Job No. L-31999

PRODUCTION TEST OF WELL

Owner CITY OF OWOSSO City OWOSSO State MICHIGAN

Well No. 1 Location PALMER ST. also show sketch on back

Measured from Ground Level: Total Depth 22'-10" Inside Dia. 12" Standing Water Level 44'

Type Well: Gravel Wall ___ Tubular X Rock ___ New ___ Old X Cleaned ___ Gravel Wall Dia ___

Screen: Length ___ Dia. ___ Slot Size ___ Type ___ Depth to Top ___

Driven by Electric (X) Engine ( ) Pump Bowl B & J Stages 5

Length Suction Pipe 10 ' Well top to bottom of Suction ___

Orifice Size 8 by 6" Water discharged 25 feet from well into ~~Pond~~

Well top to bottom of air line 86 ' Gauge reads feet (X) pounds ( )

DATE	TIME	INCHES ON ORIFICE	GALLONS PER MINUTE	AIR LINE READING	GROUND TO WATER LEVEL	DISCHARGE PRESSURE	REMARKS
	2:10	0	0	46'	44'	145 psi	Amps. Volt
5/7/68	2:15	19-1/2	699	68		115	
	2:20	19-1/2	699	68		115	110-100-110- 49
	2:25	19-1/2	699	68		115	
	2:30	19-1/2	699	68		115	
	2:35	19-1/2	699	68		115	
	2:40	19-1/2	699	68		115	49
	2:45	26	805	72		105	
	3:00	26	805	72		105	100-100-100
	3:15	42	1001	80		72-1/2	
	3:30	42	1001	80		72-1/2	
	3:45	42	1001	80		72-1/2	105-105-105- 49
	4:00	50	1089	84		50	
	Ran 15 test at 67" in orifice hose with 20# pressure drawdown was out of air.						

State fully any details on back of this sheet. Water temperature near end of test °F

Tested and Witnessed by

S. L. WINKLER
FOR LAYNE-NORTHERN COMPANY, INC.

KEITH COAKES
Witnessed by For Purchaser.

END OF SECTION 00 31 35

SECTION 00 41 13 – BID - STIPULATED SUM

Bid of _____ hereinafter called Bidder, organized and existing under the laws of or a resident of the State of _____, doing business as _____.*

*Insert as applicable: "a corporation", "a partnership" or "an individual".

To City of Owosso, hereinafter called Owner.

ARTICLE 1 – BID RECIPIENT

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 – BIDDER'S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Advertisement for Bids and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 90 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER'S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

A. Bidder has examined and carefully studied the Bidding Documents, other related data identified in the Bidding Documents, and the following Addenda, receipt of all which is hereby acknowledged:

Addendum Number	Addendum Date
_____	_____
_____	_____
_____	_____
_____	_____

B. Bidder has visited the Site and become familiar with and is satisfied as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.

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

D. Bidder has carefully studied all:

(1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the Site (except Underground Facilities) that have been identified in the Supplementary Conditions as provided in paragraph 5.03 of the General Conditions, as containing reliable "technical data," and

(2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in the Supplementary Conditions as provided in paragraph 5.06 of the General Conditions as containing reliable "technical data."

E. Bidder has considered the information known to Bidder; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on:

(1) the cost, progress, and performance of the Work;

(2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder, including applying the specific means, methods, techniques, sequences, and procedures of construction expressly required by the Bidding Documents; and

(3) Bidder's safety precautions and programs.

F. Based on the information and observations referred to in Paragraph 3.01.E above, Bidder does not consider that further examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance of the Work at the price(s) bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.

G. 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.

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

I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance of the Work for which this Bid is submitted.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

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

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

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

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

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

(2) "fraudulent practice" means an intentional misrepresentation of facts made

(a) to influence the bidding process to the detriment of Owner,

(b) to establish bid prices at artificial non-competitive levels, or

(c) to deprive Owner of the benefits of free and open competition;

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

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

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following prices:

Base Bid _____ ($_____)
(use words) (figures)

All specific cash allowances are included in the price(s) set forth above and have been computed in accordance with paragraph 13.02 of the General Conditions.

Lump Sum for Cash Allowance 1, **Special Inspections**	$50,000

List Subcontractors:*

Name of Subcontractor	Type of Work	Dollar Amount
	Demolition	
	Building	
	Electric	
	HVAC	
	Process Mechanical	

*Unless approved by the Engineer, the Contractor shall utilize the Subcontractors listed on this Bid Form.

_____
Bidder (Firm or Corporation Name)

ARTICLE 6 – TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete on or before September 1, 2026 and completed and ready for final payment in accordance with paragraph 15.06 of the General Conditions on or before October 1, 2026.

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

ARTICLE 7 – ATTACHMENTS TO THIS BID

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

A. Required Bid security.

B. List of Proposed Subcontractors;

C. List of Proposed Suppliers;

D. List of Project References;

E. Evidence of authority to do business in the state in which the Project is located; or a written covenant to obtain such license prior to the award of the Contract.

F. Required Bidder Qualification Statement with Supporting Data;

G. Certificate of Contractors General Liability and Workers Comp Insurance;

H. Drinking Water State Revolving Fund Required Documents, including;

1. Executed American Iron and Steel compliance statement.

2. Certification Regarding Debarment Suspension.

3. Complete Good Faith Efforts Worksheet and required supporting documentation.

ARTICLE 8 – DEFINED TERMS

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

_____

Bidder (Firm or Corporation Name)

ARTICLE 9 – BID SUBMITTAL

9.01 This Bid is submitted by:

SUBMITTED on _____, 20___
Date*

BY: _____
Name of Bidder*

_____
Business Street Address*

_____
Signature

_____
City, State, and Zip*

_____
Name and Title of Signatory*

_____
Telephone Number*

_____
Facsimile Number*

_____
E-mail Address*

*Typed or printed in ink.

END OF SECTION 00 41 13

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SECTION 00 43 13 – BID SECURITY FORM

Owner:
City of Owosso
301 W. Main Street
Owosso, Michigan 48867

Bid:
Bid Due Date: May 20, 2025
Project: Well Improvements
1111 Allendale Avenue, Owosso, MI 48867

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

Surety (Principal Place of Business):	Bidder:
Surety's Name of and Corporate Seal*	Bidder's Name and Corporate Seal*
Business Street Address*	Business Street Address*
City, State, Zip *	City, State, Zip *
By: Signature (Attach Power of Attorney)	By: Signature
By: (Print Name*)	By: (Print Name*)
Attest: Signature	Attest: Signature
Title*	Title*

* Typed or printed in ink.

Bond:

Bond Number:

Date (Not later than Bid due date):

Penal Sum: (Words) $ (Figures)

Note: (1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, Owner or other party shall be considered plural where applicable.

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder 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 shall be Owner's sole and exclusive remedy upon default of Bidder.

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

3. This obligation shall be null and void if:

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

3.2. All Bids are rejected by Owner, or

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

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

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

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

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

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

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

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

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

END OF SECTION 00 43 13

SECTION 00 51 00 - NOTICE OF AWARD

Dated _____, 20____

TO:_____
(Bidder)

ADDRESS:_____

_____

_____

CONTRACT: Well Improvements
1111 Allendale Avenue, Owosso, MI 48867
Project Number 241848

You are notified that your Bid dated _____, 20____ for the above Contract has been considered. You are the Successful Bidder and are awarded a Contract for the Filter Improvements

The Contract Price of your Contract is _____
_____ Dollars ($_____). Two copies of the proposed Contract Documents as identified in the Agreement accompany this Notice of Award.

You must comply with the following conditions precedent within 15 days of the date of this Notice of Award, that is by _____, 20____.

1. Deliver to the Owner two fully executed counterparts of the Contract Documents which accompany this Notice of Award, each of which must bear your signature at the designated location.

2. Deliver with the Executed Contract Documents the Contract security (bonds) as specified in the Instructions to Bidders (Article 20).

3. Deliver with the Executed Contract Documents the insurance documents as specified in the General Conditions (Article 6) and the Supplementary Conditions (Article SC-6).

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 executed counterpart of the Contract Documents.

City of Owosso

By: _____
(Authorized Signature)

_____
(Name and Title)

*Typed or printed in ink

Copy to Engineer

END OF SECTION 00 51 00

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SECTION 00 52 00 – AGREEMENT FORM

THIS AGREEMENT is by and between City of Owosso ("Owner") and _____
_____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 - WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: Well Improvements

ARTICLE 2 - THE PROJECT

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

ARTICLE 3 - ENGINEER

3.01 The Project has been designed by Fishbeck ("Engineer,") which is to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 4 - CONTRACT TIME

4.01 TIME OF THE ESSENCE

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

4.02 DATES FOR SUBSTANTIAL COMPLETION AND FINAL PAYMENT

A. The Work will be substantially completed on or before day, September 1, 2026 and completed and ready for final payment in accordance with Paragraph 15.07 of the General Conditions on or before day, October 1, 2026.

4.03 LIQUIDATED DAMAGES

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial loss if the Work is not completed within the times specified in Paragraph 4.02 above, plus any extensions thereof allowed in accordance with Article 11 of the General Conditions. 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)

B. Substantial Completion: Contractor shall pay Owner One Thousand Dollars ($1,000) for each day that expires after the time specified in Paragraph 4.02 above for Substantial Completion until the Work is substantially complete.

After Substantial Completion, if Contractor shall neglect, refuse or fail to complete the remaining Work within the Contract Time or any proper extension thereof granted by Owner, Contractor shall pay Owner One Thousand Dollars ($1,000) for each day that expires after the time specified in Paragraph 4.02 above for completion and readiness for final payment until the Work is completed and ready for final payment.

C. Liquidated damages for failure to meet the specified Substantial Completion date and for failure to meet the specified Final Completion date will not be assessed simultaneously.

ARTICLE 5 - CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, in current funds, a total amount of Dollars ($).

ARTICLE 6 - PAYMENT PROCEDURES

6.01 SUBMITTAL AND PROCESSING OF PAYMENTS

A. Payments and retainage of payments shall be in accordance with State of Michigan Act No. 524 of the Public Acts of 1980. Contractor shall submit applications for payment in accordance with Article 15 of the General Conditions. The person representing Contractor who shall submit Application for Payment will be _____. The person to whom Application for Payment are to be submitted is Engineer. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 PROGRESS PAYMENTS; RETAINAGE

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment during performance of the Work as provided in Paragraphs 6.02. A.1 and 6.02.A.2 below. All such payments will be measured by the schedule of values established in Paragraph 2.05 of the General Conditions.

1. Prior to Substantial Completion, progress payments will be in an amount equal to: 100% of the Work completed and 100% of materials and equipment not incorporated in the Work but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in Paragraph 15.01 of the General Conditions less the aggregate of payments previously made and less such amounts as Engineer may determine, or Owner may withhold, including but not limited to liquidated damages, in accordance with Paragraph 15.01 of the General Conditions, except that Owner will retain a portion of each progress payment limited to:

a. Not more than 10% of the dollar value of the Work completed until 50% of the Work has been completed as determined by Engineer.

b. After the Work has been 50% completed as determined by Engineer, additional retainage will not be withheld unless Owner determines that Contractor is not making satisfactory progress, or for other specific cause relating to Contractor's performance under the Contract. If Owner so determines, Owner may retain not more than 10% of the dollar value of the Work more than 50% completed.

2. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to 95% of the Contract Price, less such amounts as Engineer shall determine, or Owner may withhold, in accordance with Paragraph 15.01 B.5 and 15.01 B.6.of the General Conditions.

3. Owner may deduct from progress payments amounts which are due to Owner from Contractor in accordance with the Contract Documents.

4. After Substantial Completion, Owner may, at Owner's sole discretion, pay an amount sufficient to increase total payments to Contractor to more than 95% of the Contract Price if Owner has received consent of surety in a form acceptable to Owner

5. Progress payments shall not be due until 15 days after Owner has received the funds with which to make the progress payment from a department or agency of the federal or state government, if any funds are to come from either of these sources.

B. The retained funds will not be commingled with other funds of Owner and will be deposited in an interest bearing account in a regulated financial institution in this state wherein all such retained funds are kept by Owner which will account for both retainage and interest on each construction contract separately.

C. Owner is not required to deposit retained funds in an interest bearing account if the retained funds are to be provided under a state or federal grant and the retained funds have not been paid to Owner.

D. Owner, at any time after 94% of work under the contract has been completed as determined by Engineer and at the request of Contractor, will release the retainage plus interest to Contractor only if Contractor provides to Owner an irrevocable letter of credit in the amount of the retainage plus interest, issued by a bank authorized to do business in this state, containing terms mutually acceptable to Contractor and Owner.

E. Unresolved disputes between Owner and Contractor regarding retained funds and interest on retained funds shall be submitted to an agent in accordance with the dispute resolution process described in Section 4 of State of Michigan Act 524 of P.A. of 1980.

6.03 FINAL PAYMENT

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

ARTICLE 7 - INTEREST

7.01 All moneys not paid when due as provided in Article 15 of the General Conditions shall bear interest at the rate of 1% per month.

ARTICLE 8 - CONTRACTOR'S REPRESENTATIONS

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

A. Contractor has examined and carefully studied the Contract Documents and the other related data identified in the Bidding Documents.

B. Contractor has visited the Site and become familiar with and is satisfied as to the general, local and Site conditions that may affect cost, progress, and performance of the Work.

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

D. Contractor has carefully studied all:

(1) reports of explorations and tests of subsurface conditions at or contiguous to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities), if any, that have been identified Paragraph 5.03 of the Supplementary Conditions as provided in Paragraph 5.03 of the General Conditions as containing reliable “technical data,” and

(2) reports and drawings of Hazardous Environmental Conditions, if any, at the Site that have been identified in Paragraph 5.06 of the Supplementary Conditions as provided in paragraph 5.06 of the General Conditions as containing reliable “technical data.”

E. Contractor has considered the information known to Contractor; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Site-related reports and drawings identified in the Contract Documents, with respect to the effect of such information, observations, and documents on

(1) the cost, progress, and performance of the Work;

(2) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, including any specific means, methods, techniques, sequences, and procedures of construction expressly required by the Contract Documents; and

(3) Contractor’s safety precautions and programs.

F. based on the information and observations referred to in Paragraph 8.01.E above, Contractor does not consider that any 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 Documents.

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

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

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

ARTICLE 9 - CONTRACT DOCUMENTS

9.01 CONTENTS

A. The Contract Documents consist of the following:
1. Contractor's Bid dated _____.
2. Addenda _____ to _____, inclusive.
3. Notice of Award.
4. This Agreement.
5. Performance Bond.
6. Payment Bond.
7. General Conditions.
8. Supplementary Conditions.
9. Specifications as listed in the table of contents of the Project Manual.
10. Drawings, consisting of sheets as listed on the cover sheet with each sheet bearing the following general title: Well Improvements and dated April 16, 2025 (not included in the executed Contract Documents).
11. The following which may be delivered or issued on or after the Effective Date of the Agreement and are not attached hereto:
    a. Work Change Directives;
    b. Change Orders.

B. The documents listed in Paragraph 9.01.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 9.

D. The Contract Documents may only be amended, modified or supplemented as provided in Paragraph 11.01 of the General Conditions.

ARTICLE 10 - MISCELLANEOUS

10.01 TERMS

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

10.02 ASSIGNMENT OF CONTRACT

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

10.03 SUCCESSORS AND ASSIGNS

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

10.04 SEVERABILITY

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

10.05 CONTRACTOR'S CERTIFICATIONS

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

(1) "corrupt practice" means the offering, giving, receiving, or soliciting of any thing 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 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.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. Counterparts have been delivered to Owner, Contractor and Engineer. All portions of the Contract Documents have been signed or identified by Owner and Contractor or on their behalf.

Contractor:

_____
Name of Contractor*

By:_____
Signature

_____
(Name and Title of Signatory*)

Attest:_____

_____
(Name and Title of Signatory*)

Signed on:_____, 20___
(Date*)

Address for giving notices:

_____
(Street*)

_____
(City, State and Zip*)

License No. _____ (Where applicable)

Agent for service of process: _____

(If Contractor is a corporation or a partnership, attach evidence of authority to sign.)

Designated Representative:

_____
(Name*)

_____
(Title*)

_____
(Street*)

_____
(City, State and Zip*)

_____
(Telephone Number*)

_____
(Facsimile*)

Owner:
City of Owosso

By:_____
Signature

_____
(Name and Title of Signatory*)

Attest:_____

_____
(Name and Title of Signatory*)

Signed on:_____, 20___
(Effective Date of Agreement*)

Address for giving notices:

_____
(Street*)

_____
(City, State and Zip*)

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

Designated Representative:

_____
(Name*)

_____
(Title*)

_____
(Street*)

_____
(City, State and Zip*)

_____
(Telephone Number*)

_____
(Facsimile*)

* Typed or printed in ink.

END OF SECTION 00 52 00

SECTION 00 61 14 – PERFORMANCE BOND FORM

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

Contractor (Name and Address):

_____

_____

Surety (Name and Address of Principal Place of Business):

_____

_____

Owner

City of Owosso
301 W. Main Street
Owosso, Michigan 48867

CONTRACT

Date (Date of Notice of Award): _____
Amount: _____
Description: Well Improvements
1111 Allendale Avenue, Owosso, MI 48867

BOND

Bond Number: _____
Date (Not earlier than Contract Date): _____
Amount: _____
Modifications to this Bond form: _____

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

Contractor AS PRINCIPAL	SURETY
_____ (Seal)	_____ (Seal)
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

IMPORTANT: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in Michigan. Attach Power of Attorney for those signatures executing for Surety, certifying authority to bind the Surety as of the date of the Bond:

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

2. If Contractor performs the Contract, the Surety and Contractor have no obligation under this Bond, except to participate in conferences as provided in paragraph 3.1.

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

3.1. Owner has notified Contractor and Surety at the addresses described in Paragraph 10 below, that Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with Contractor and Surety to be held not later than 15 days after receipt of such notice to discuss methods of performing the Contract. If Owner, Contractor and Surety agree, Contractor shall be allowed a reasonable time to perform the Contract, but such an agreement shall not waive Owner's right, if any, subsequently to declare a Contractor Default; and

3.2. Owner has declared a Contractor Default and formally terminated Contractor's right to complete the Contract. Such Contractor Default shall not be declared earlier than 20 days after Contractor and Surety have received notice as provided in paragraph 3.1; and

3.3. Owner has agreed to pay the Balance of the Contract Price to:

3.3.1. Surety in accordance with the terms of the Contract; or

3.3.2. Another contractor selected pursuant to paragraph 4.3 to perform the Contract.

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

4.1. Arrange for Contractor, with consent of Owner, to perform and complete the Contract; or

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

4.3. Obtain bids or negotiated proposals from qualified contractors acceptable to Owner for a contract for performance and completion of the Contract, arrange for a contract to be prepared for execution by Owner and contractor selected with Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Contract, and pay to Owner the amount of damages as described in Paragraph 6 in excess of the Balance of the Contract Price incurred by Owner resulting from Contractor Default; or

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

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

4.4.2. Deny liability in whole or in part and notify Owner citing reasons therefor.

5. If Surety does not proceed as provided in paragraph 4 with reasonable promptness, Surety shall be deemed to be in default on this Bond 15 days after receipt of an additional written notice from Owner to Surety demanding that Surety perform its obligations under this Bond, and Owner shall be entitled to enforce any remedy available to Owner. If Surety proceeds as provided in Subparagraph 4.4, and Owner refuses the payment tendered or Surety has denied liability, in whole or in part, without further notice Owner shall be entitled to enforce any remedy available to Owner.

6. After Owner has terminated Contractor's right to complete the Contract, and if Surety elects to act under paragraph 4.1, 4.2, or 4.3 above, then the responsibilities of Surety to Owner shall not be greater than those of Contractor under the Contract, and the responsibilities of Owner to Surety shall not be greater than those of Owner under the Contract. To the limit of the amount of this Bond, but subject to commitment by Owner of the Balance of the Contract Price to mitigation of costs and damages on the Contract, the Surety is obligated without duplication for:

6.1. The responsibilities of Contractor for correction of defective Work and completion of the Contract;

6.2. Additional legal, design professional and delay costs resulting from Contractor's Default, and resulting from the actions of or failure to act of Surety under Paragraph 4; and

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

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

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

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the Work or part of the Work is located and shall be instituted within 2 years after Contractor Default or within 2 years after Contractor ceased working or within 2 years after 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 period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to Surety, Owner or Contractor shall be mailed or delivered to the address indicated on the signature page.

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

12. Definitions:

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

12.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

12.3. Contractor Default: Failure of Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Contract.

12.4. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract or to perform and complete or comply with the other terms thereof.

END OF SECTION 00 61 14

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SECTION 00 61 15 – PAYMENT BOND FORM

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable.

Contractor (Name and Address):

_____

_____

Surety (Name and Address of Principal Place of Business):

_____

_____

Owner

City of Owosso
301 W. Main Street
Owosso, Michigan 48867

CONTRACT

Date (Date of Notice of Award): _____
Amount: _____
Description: Well Improvements
1111 Allendale Avenue, Owosso, MI 48867

BOND

Bond Number: _____
Date (Not earlier than Contract Date): _____
Amount: _____
Modifications to this Bond Form: _____

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

Contractor AS PRINCIPAL	SURETY
_____ (Seal)	_____ (Seal)
Contractor's Name and Corporate Seal	Surety's Name and Corporate Seal
By: _____	By: _____
Signature	Signature (Attach Power of Attorney)
_____	_____
Print Name	Print Name
_____	_____
Title	Title
Attest: _____	Attest: _____
Signature	Signature
_____	_____
Title	Title

IMPORTANT: Surety companies executing Bonds must appear on the Treasury Department's most current list (Circular 570 as amended) and be authorized to transact business in Michigan. Attach Power of Attorney for those signatures executing for Surety, certifying authority to bind Surety as of the date of the Bond.

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

2. With respect to Owner, this obligation shall be null and void if Contractor:

2.1. promptly makes payment, directly or indirectly, for all sums due Claimants, and

2.2. defends, indemnifies and holds harmless Owner from all claims, demands, liens or suits alleging non-payment by Contractor by any person or entity who furnished labor, materials or equipment for use in the performance of the Contract, provided Owner has promptly notified Contractor and Surety (at the addresses described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to Contractor and Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if Contractor promptly makes payment, directly or indirectly, for all sums due.

4. Surety shall have no obligation to Claimants under this Bond until:

4.1. Claimants who are employed by or have a direct contract with Contractor have given notice to Surety (at the addresses described in paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

4.2. Claimants who do not have a direct contract with Contractor:

4.2.1. Have furnished written notice to Contractor and sent a copy, or notice thereof, to Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

4.2.2. Have either received a rejection in whole or in part from Contractor, or not received within 30 days of furnishing the above notice any communication from Contractor by which Contractor had indicated the claim will be paid directly or indirectly; and

4.2.3. Not having been paid within the above 30 days, have sent a written notice to Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to Contractor.

5. If a notice required by Paragraph 4 is given by Owner to Contractor or to Surety,, that is sufficient compliance.

6. Reserved.

7. Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

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

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

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

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the Work or part of the Work is located or after the expiration of one year from the date (1) on which the Claimant give the notice required by paragraph 4.1 or paragraph 4.2.3, 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 Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to Surety, Owner or Contractor shall be mailed or delivered to the addresses indicated on the signature page. Actual receipt of notice by Surety, Owner or Contractor, however accomplished, shall be sufficient compliance as of the date received at the address indicated on the signature page.

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

14. Upon request of any person or entity appearing to be a potential beneficiary of this Bond, Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. DEFINITIONS:

15.1. Claimant: An individual or entity having a direct contract with Contractor or with a first-tier Subcontractor of Contractor, to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Contract, architectural and engineering services required for performance of the Work of Contractor and 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.

15.2. Contract: The agreement between Owner and Contractor identified on the signature page, including all Contract Documents and changes thereto.

15.3. Owner Default: Failure of Owner, which has neither been remedied nor waived, to pay Contractor as required by the Contract, or to perform and complete or comply with the other terms thereof.

END OF SECTION 00 61 15

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SECTION 00 65 16 – CERTIFICATE OF SUBSTANTIAL COMPLETION FORM

Date of Issuance: _____

Owner: _____

Contractor: _____

Contract: Well Improvements
1111 Allendale Avenue, Owosso, MI 48867
Project Number 241848

This definitive Certificate of Substantial Completion applies to all Work under the Contract Documents.

_____
Date of Substantial Completion

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby declared and is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

A definitive list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in such list does not alter the responsibility of the Contractor to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by Contractor within 60 days of the above Date of Substantial Completion .

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance and warranties shall be as provided in the Contract Document, except as amended as follows:

Owner's Amended Responsibilities: _____
_____
_____

Contractor's Amended Responsibilities: _____
_____
_____

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

1. List of items to be completed or corrected before final payment.

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

Executed by Engineer on _____
Date

_____
Engineer

By: _____
(Authorized Signature)

Contractor accepts this Certificate of Substantial Completion on _____
Date

_____
Contractor

By: _____
(Authorized Signature)

Owner accepts this Certificate of Substantial Completion on _____
Date

_____
Owner

By: _____
(Authorized Signature)

END OF SECTION 00 65 16

SECTION 00 65 26 – AFFIDAVIT AND CONSENT OF SURETY

STATE OF MICHIGAN)
) ss.
COUNTY OF _____)

The undersigned Contractor, being duly sworn, deposes and says that he entered into an Agreement (Contract) with City of Owosso *(*Owner), on the _____ day of _____ 20___, for the performance of certain Work generally described as follows: Well Improvements.

Contractor further says that the Work under the terms of the Contract has been completed and all sums due to Contractors, Subcontractors, Suppliers and laborers with whom Contractor has contracted for performance under the Contract have been paid in full.

Furthermore, in consideration of final payment under the Contract, Contractor hereby waives and releases any and all claims or rights which Contractor may have in connection with the Contract against Owner or the premises upon which the Work was performed, and agrees to indemnify Owner against any and all such claims or rights which may be asserted by Contractors, Subcontractors, Suppliers or laborers with whom Contractor has contracted for performance under the Contract.

Signed in the presence of:

_____ _____
Contractor*

_____ _____
Signature

_____
Name and Title*

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

_____
Notary Public _____

My commission expires:_____ County _____

CONSENT OF SURETY

The undersigned, as Surety on the Contract, hereby consents to the making of final payment to the Contractor under the Contract.

Date:_____, 20__

_____
Surety Company*

_____
Attorney-in-Fact (Signature)

_____
Name and Title*

*Typed or printed in ink.

(Attach copy of power of attorney certified to date of consent.)

END OF SECTION 00 65 26

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

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared By

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ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

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

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

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

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

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

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

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

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

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

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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

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

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

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

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

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

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

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

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

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

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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

1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

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

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

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

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

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

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

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

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

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

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

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

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

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

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

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

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

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

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

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

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

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

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

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

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

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

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

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

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

    b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

    c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

    a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

    b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

    c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

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

2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

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

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

    a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

    b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

    c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

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

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

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

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition

and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

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

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the

required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

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

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed

by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

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

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will

provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

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

2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

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

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

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

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or

description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

    a. in the exercise of reasonable judgment Engineer determines that the proposed item:

        1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

        2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

        3) has a proven record of performance and availability of responsive service; and

        4) is not objectionable to Owner.

    b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

        1) there will be no increase in cost to the Owner or increase in Contract Times; and

        2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that

Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.
3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
    a. will certify that the proposed substitute item will:
        1) perform adequately the functions and achieve the results called for by the general design;
        2) be similar in substance to the item specified; and
        3) be suited to the same use as the item specified.
    b. will state:
        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
    c. will identify:
        1) all variations of the proposed substitute item from the item specified; and
        2) available engineering, sales, maintenance, repair, and replacement services.
    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a

Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation.

Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as

being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

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

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such

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

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when

Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

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

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

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

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is

not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;
2. Recommendation by Engineer or payment by Owner of any progress or final payment;
3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
4. Use or occupancy of the Work or any part thereof by Owner;
5. Any review and approval of a Shop Drawing or Sample submittal;
6. The issuance of a notice of acceptability by Engineer;
7. The end of the correction period established in Paragraph 15.08;
8. Any inspection, test, or approval by others; or
9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

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

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

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

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

3. The extent of such authority and responsibilities.

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

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

   1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

   2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or

arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

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

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the

responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

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

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

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

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of

inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

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

ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

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

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

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

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);

2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or

3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:

1. A mutually acceptable fixed fee; or

2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;

b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;

c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;

d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and

f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

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

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

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

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

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

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

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

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

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

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

D. *Mediation*

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

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

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

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

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

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

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

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors

acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

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

    c. *Construction Equipment Rental*

        1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

        2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

        3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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

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

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, 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 Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

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

13.02 *Allowances*

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

B. *Cash Allowances*: Contractor agrees that:

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

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

    a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

    b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

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

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

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

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

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

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

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

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

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

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

   a. to supervise, direct, or control the Work;

   b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

   c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

   d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

   e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

   a. the Work is defective, requiring correction or replacement;

   b. the Contract Price has been reduced by Change Orders;

   c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

   d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining

after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work,

property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

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

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents;

b. consent of the surety, if any, to final payment;

c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all duly pending Change Proposals and Claims; and

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

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is

acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim, appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

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

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;

2. correct such defective Work;

3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced.

Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

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

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

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in

connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

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

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

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

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

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

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

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

18.09 *Successors and Assigns*

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

18.10 *Headings*

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

SECTION 00 73 00 - SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the General Conditions (Standard General Conditions of the Construction Contract). All provisions which are not so amended or supplemented remain in full force and effect.

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 in the General conditions, with the Prefix "SC" added thereto.

The Contract Documents include 00 73 40 - Standard Contract Requirements for Drinking Water State Revolving Fund projects as required by State of Michigan. The provisions of these Sections shall be complied with in addition to the provisions of the General Conditions and the Supplementary Conditions. If conflicts exist among these Sections, the stricter requirements, as determined by Engineer, shall govern.

ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

SC-1.01 Defined Terms

Add the following language to the first sentence of Paragraph 1.01.A:

; except where the terms "Architect," "Engineer," and "Contractor" are preceded by an adjective, the term shall then be understood to refer to the entity described by the combination of the two words.

SC-1.01.A.22 Engineer

Delete Paragraph 1.01.A.22 in its entirety and insert the following in its place:

22. Engineer - The individual or entity named as Engineer or Architect in the Agreement.

SC-1.01.A.42 Substantial Completion

Add the following paragraph immediately after Paragraph 1.01.A.42:

Substantial Completion shall also mean that, with the exception of minor, superficial, or other specific items of the Work as indicated in the specifications or approved by Engineer, construction activities are completed.

Substantial Completion shall specifically include the following items:

a. General:
   (1) The process is ready for Owner's intended use.
   (2) The building is permitted for occupation by authorities having jurisdiction.
b. Process Piping and Valves:
   (1) Pressure and leak tested.
c. Instrumentation:
   (1) All instrumentation devices (field devices and panel or computer screen displays) have been calibrated.
   (2) All set points have been checked and verified.
   (3) All interlocks have been tested.
   (4) Operations and maintenance (O&M) training completed.
   (5) O&M documents submitted to Engineer and Owner.
d. Process Blowers and Underdrain Equipment:
   (1) All equipment tested for proper operation.
   (2) O&M training completed.
   (3) O&M documents submitted to Engineer and Owner.

e. Painting:
   (1) Complete except for touch up.
   (2) In every case, paint all items to be painted which cannot be taken out of service or isolated from the process after the process has been started. This includes process piping and areas adjacent to potable water.
f. HVAC and Electrical:
   (1) Completed and approved by local permitting agency.
   (2) Ready for operation.
   (3) Training for appropriate season of startup shall be complete.
   (4) Testing/balancing reports submitted to Engineer.

Add the following paragraphs immediately after Paragraph 1.01.A.50:

51. Architect - The individual or entity named as Architect or Engineer in the Agreement.

52. Bulletin **-** A document delineating possible changes to the Contract Documents which is issued by Engineer for Owner and requests add or deduct costs from Contractor.

53. General Contractor - The Contractor as defined in Paragraph 1.01.A.16.

54. Manufacturer - An individual or entity that manufactures, assembles, or fabricates Products.

55. Products **-** Systems, materials, manufactured units, equipment, components and accessories used in the Work.

56. Request for Information (or RFI): A written document initiated by Contractor which requests clarifications to items of the Work from Engineer.

ARTICLE 2 - PRELIMINARY MATTERS

SC-2.01 Delivery of Performance and Payment Bonds and Evidence of Insurance

Delete Paragraph 2.01.B in its entirety and insert the following in its place:

B. When Contractor delivers the executed Agreements to Owner, Contractor shall also deliver to Owner, with copies to each additional insured identified herein, certificates of insurance (and other evidence of insurance which Owner or any additional insured may reasonably request) which Contractor is required to purchase and maintain in accordance with Article 6.

SC-2.02 Copies of Documents

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

Owner shall furnish to Contractor one printed copy of the Contract Documents (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional copies will be furnished upon request at the cost of preparation, reproduction, and shipping.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

SC-3.01 Intent

Delete Paragraph 3.01.C in its entirety.

SC-3.04 Requirements of the Contract Documents

Add the following new paragraph immediately after Paragraph 3.04.C.:

D. Owner shall be entitled to deduct from the Contract Price amounts paid to Engineer for Engineer to evaluate and respond to Contractor's requests for information, where such information was available to Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

ARTICLE 5 - SITE, SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

Add the following new paragraph immediately after Paragraph 5.01.C:

D. No known historical drawing exist

SC-5.03 Subsurface and Physical Conditions

Add the following new paragraphs immediately after Paragraph 5.03.D.4:

E. The following reports of explorations and tests of subsurface conditions at or contiguous to the Site are known to Owner:

1. Report dated January 30, 2025, prepared by MTC entitled: Geotechnical Borings consisting of 23 pages. The "technical data" contained in such report upon which Contractor may rely is the soil boring logs at the locations and for the conditions at the time the soil borings were taken.

SC-5.06 Hazardous Environmental Condition at Site

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

1. contractor responsible to complete, cover cost, and provide any required material inspection, testing, reports.

ARTICLE 6 - BONDS AND INSURANCE

SC-6.03 Contractor's Insurance

Delete Paragraph 6.03.B.3 in its entirety and insert the following in its place:

3. remain in effect at least until the end of the correction period and at all times thereafter when Contractor may be correcting, removing or replacing defective Work in accordance with Paragraph 15.06; and

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:

1. Fishbeck;
2. MTC

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
Employer's Liability	
Each accident	$ 1,000,000
Each employee	$ 1,000,000
Policy limit	$ 1,000,000

F. Commercial General Liability—Claims Covered: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. Commercial General Liability—Form and Content*:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
   a. Such insurance must be maintained for three years after final payment.
   b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. Commercial General Liability—Excluded Content*:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.

4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. Commercial General Liability—Minimum Policy Limits

Commercial General Liability	Policy limits of not less than:
General Aggregate	$ 1,000,000
Products—Completed Operations Aggregate	$ 1,000,000
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:
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$ 1,000,000

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 excess policy must retain a minimum limit of $1,000,000 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	$ 3,000,000
General Aggregate	$ 3,000,000

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.04 Services, Materials and Equipment

Add the following language at the end of Paragraph 6.03.A:

Owner requires that the rates of wages and fringe benefits to be paid to each class of mechanics by Contractor and all Subcontractors shall be not less than the wage and fringe benefit rates prevailing in the locality in which the Work is to be performed. Prevailing wage and fringe benefit rates shall be determined in accordance with the schedules published.

SC-7.09 Permits

Add the following language at the end of Paragraph 7.09.A:

Additional provisions regarding permits and licenses are included in the General Requirements.

In the last sentence of Paragraph 7.09.A., replace "Owner" with "Contractor."

SC-7.11 Laws and Regulations

Add the following paragraph immediately after Paragraph 7.11.C:

D. Funding for the Project is provided in part by the State of Michigan Drinking Water State Revolving Fund and Contract Documents reflect the requirements of that authority.

SC-7.16 Shop Drawings and Sample Requirements

Add the following new paragraphs immediately after Paragraph 7.16.D.3:

4. Contractor shall furnish required submittals with sufficient information and accuracy in order to obtain required approval of an item with no more than two submittals. Engineer will record Engineer's time for reviewing subsequent submittals of Shop Drawings, samples, or other items requiring approval and Owner will deduct amount paid for Engineer's charges for such time from payment to Contractor.

SC-8.04 Add the following new paragraph immediately after Paragraph GC-8.03:

SC-8.04 Claims Between Contractors

A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, then Contractor (without involving Owner, Engineer, or construction coordinator) shall either (1) remedy the damage, (2) agree to compensate the other contractor for remedy of the damage, or (3) remedy the damage and attempt to settle with such other contractor by agreement, or otherwise resolve the dispute by arbitration or at law.

B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner, Engineer, the construction coordinator and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, consultants, or the construction coordinator to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the construction coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or the construction coordinator on account of any such damage or Claim.

C. If Contractor is delayed at any time in performing or furnishing the Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or construction coordinator for activities that are their respective responsibilities.

ARTICLE 10 - ENGINEER'S STATUS DURING CONSTRUCTION

SC-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.

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

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 10 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 15 - PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

SC-15.01.B Applications for Payment

Add the following new paragraph immediately after Paragraph 15.01.B.4:

5. Contractor shall indicate on the Application for Payment the amounts which are due to Owner from Contractor in accordance with the Contract Documents and which amounts Owner may deduct from the progress payment.

SC-15.01.C Review of Applications

Add the following new paragraphs immediately after Paragraph 15.01.C.6.e:

f. Contractor has incurred liability for other costs in accordance with Contract Documents.

g. liability for liquidated damages has been incurred by Contractor.

h. of Contractor's failure to maintain record documents in accordance with Paragraph 7.12.

SC-15.03 Substantial Completion

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.

ARTICLE 16 - SUSPENSION OF WORK AND TERMINATION

SC-16.02 Owner May Terminate for Cause

Add the following new paragraph immediately after Paragraph 16.02.A.4:

5. Contractor has filed a bankruptcy petition and neither Contractor nor trustee has either assumed or rejected this Contract within 30 days after the filing of the bankruptcy petition;

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

Add the following paragraphs after 17.01 Methods and Procedures:

SC-17.02 Arbitration

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, 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.

Add the following new paragraph immediately after Paragraph 17.02

17.03 Attorneys' Fees

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

END OF SECTION 00 73 00

SECTION 00 73 40 – STANDARD CONTRACT REQUIREMENT: DRINKING WATER STATE REVOLVING FUND

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. American Iron and Steel Contract Language.
   1. The Contractor acknowledges to and for the benefit of the City of Owosso ("Purchaser") and the Michigan Department of Environment, Great Lakes, and Energy (the "State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or the Drinking Water State Revolving Fund and such laws contain provisions commonly known as "American Iron and Steel (AIS);" that requires all iron and steel products used in the project be produced in the United States ("AIS Requirements") including iron and steel provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the AIS Requirements, (b) all iron and steel used in the project will be and/or have been produced in the United States in a manner that complies with the AIS Requirements, unless a waiver of the requirements is approved or the State made the determination in writing that the AIS Requirements do not apply to the project, and (c) the Contractor will provide any further verified information, certification, or assurance of compliance with this paragraph, or information necessary to support a waiver of the AIS requirements, as may be requested by the Purchaser.
   2. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

B. Davis-Bacon and Related Acts/Prevailing Federal Wages.
   1. P.L. 111-88 requires compliance with the Davis Bacon Act and adherence to the current U.S. Department of Labor Wage Decision. Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Contract Documents (see Wage Decision included herein) must be paid on this project. The Wage Decision, including modifications, must be posted by the Contractor on the job site. The "Contracting Agency" or "Contracting Officer" for Davis-Bacon Wage Decision posters on jobsites is the loan applicant/bond issuer. A copy of the Labor Standard Provisions for Federally Assisted Projects is included and is hereby a part of this contract.
   2. Davis-Bacon Wage Decision for Shiawassee County, Michigan:
      a. The Wage Decision that will apply are those which are published at https://sam.gov/content/wage-determinations 10 days prior to Bid opening.
   3. Questions regarding prevailing wage and labor standards provisions should be directed to the Department of Labor.
   4. See additional Attachment to this Section, provided for information only.

C. Disadvantaged Business Enterprises (DBE) Requirements
   1. Prime contractors bidding on this project must follow, document, and maintain documentation of their Good Faith Efforts (GFE), as listed below, to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach. Bidders must make the following Good Faith Efforts for any work that will be subcontracted.
      a. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. Place DBEs on solicitation lists and solicit DBEs whenever they are potential sources.

b. Make information on forthcoming opportunities available to DBEs. Arrange timeframes for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. Whenever possible, post solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date. The DBEs should be given a minimum of 5 days to respond to the posting.
c. Consider in the contracting process whether firms competing for large contracts can be subcontracted with DBEs. Divide total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.
d. Encourage contracting with a consortium of DBEs when a contract is too large for one DBE firm to handle individually.
e. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.

2. Subsequent to compliance with the Good Faith Efforts, the following conditions also apply under the DBE requirements. Completed Good Faith Efforts Worksheets, along with the required supporting documentation outlined in the instructions, must be submitted with your bid proposal. EPA form 6100-2 must also be provided at the pre-bid meeting. A copy of this form is available on the Forms and Guidance page of the EGLE Water Infrastructure Financing Section website.
   a. The prime contractor must pay its subcontractor for work that has been satisfactorily completed no more than 30 days from the prime contractor's receipt of payment from the owner.
   b. The prime contractor must notify the owner in writing prior to the termination of any DBE subcontractor for convenience by the prime contractor and employ the Good Faith Efforts if soliciting a replacement contractor.
   c. If a DBE contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the Good Faith Efforts if soliciting a replacement contractor.
   d. The prime contractor must employ the Good Faith Efforts

D. Good Faith Efforts:
1. The prime Contractor must provide a completed Good Faith Efforts Worksheet with its Bid or proposal package to the Owner. See Section 00 41 13 - Bid – Stipulated Sum.

E. Debarment Certification:
1. The prime Contractor must provide a completed Certification Regarding Debarment Suspension, and Other Responsibility Matters Form with its Bid or proposal package to the Owner. See Section 00 41 13 – Bid – Stipulated Sum.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 00 73 40

American Iron and Steel Contract Language

The Contractor acknowledges to and for the benefit of the City of Owosso ("Owner") and the Michigan Department of Environment, Great Lakes, and Energy (the " State") that it understands the goods and services under this Agreement are being funded with monies made available by the Clean Water State Revolving Fund and/or the Drinking Water State Revolving Fund and such laws contain provisions commonly known as "American Iron and Steel (AIS);" that requires all iron and steel products used in the project be produced in the United States ("AIS Requirements") including iron and steel provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Purchaser and the State that (a) the Contractor has reviewed and understands the AIS Requirements, (b) all iron and steel used in the project will be and/or have been produced in the United States in a manner that complies with the AIS Requirements, unless a waiver of the requirements is approved or the State made the determination in writing that the AIS Requirements do not apply to the project, and (c) the Contractor will provide any further verified information, certification, or assurance of compliance with this paragraph, or information necessary to support a waiver of the AIS requirements, as may be requested by the Purchaser.

Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Purchaser or State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Purchaser or State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, from the State or any damages owed to the State by the Purchaser). While the Contractor has no direct contractual privity with the State, as a lender to the Purchaser for the funding of its project, the Purchaser and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

Davis-Bacon and Related Acts/Prevailing Federal Wages

P.L. 111-88 requires compliance with the Davis Bacon Act and adherence to the current U.S. Department of Labor Wage Decision. Attention is called to the fact that not less than the minimum salaries and wages as set forth in the Contract Documents (see Wage Decision included herein) must be paid on this project. The Wage Decision, including modifications, must be posted by the Contractor on the job site. The “Contracting Agency” or “Contracting Officer” for Davis-Bacon Wage Decision posters on jobsites is the loan applicant/bond issuer. A copy of the Labor Standards Provisions for Federally Assisted Projects is included and is hereby a part of this contract.

"General Decision Number: MI20250044 01/03/2025

Superseded General Decision Number: MI20240044

State: Michigan

Construction Type: Heavy

Counties: Arenac, Branch, Gladwin, Hillsdale, Huron, Lenawee, Mecosta, Midland, Osceola, Shiawassee and Tuscola Counties in Michigan.

Heavy, Includes Water, Sewer Lines and Excavation (Excludes Hazardous Waste Removal; Coal, Oil, Gas, Duct and other similar Pipeline Construction)

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)(1).

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 $17.75 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 2025.
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 $13.30 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 2025.

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 01/03/2025

CARP0100-005 06/01/2023

MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 27.63	20.93

CARP0525-008 06/01/2023

BRANCH & HILLSDALE COUNTIES

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 28.29	21.42

CARP0706-014 06/01/2024

ARENAC, GLADWIN, HURON, MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 33.11	23.64

CARP0706-018 06/01/2024

SHIAWASSEE COUNTY

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 33.71	23.19

CARP1004-013 06/01/2024

LENAWEE COUNTY

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 27.73	21.06

ELEC0008-012 05/25/2024

HILLSDALE & LENAWEE COUNTIES

	Rates	Fringes
ELECTRICIAN.....	$ 48.40	1.5%+17.06

ELEC0058-008 06/28/2024

HURON COUNTY

	Rates	Fringes
ELECTRICIAN.....	$ 51.32	28.54

ELEC0275-009 06/01/2024

MECOSTA COUNTY

	Rates	Fringes

ELECTRICIAN.....$ 36.52 41%+10.18

ELEC0275-014 06/01/2024

OSCEOLA COUNTY (Townships of Richmond, Hersey, Evart & Orient)

	Rates	Fringes
ELECTRICIAN	$ 36.52	41%+10.18

ELEC0445-008 06/01/2024

BRANCH COUNTY

	Rates	Fringes
ELECTRICIAN	$ 38.96	25.14

ELEC0498-012 06/01/2024

OSCEOLA COUNTY (does not include the townships of Evart, Hersey, Orient and Richmond)

	Rates	Fringes
ELECTRICIAN	$ 36.62	36.6%+9.65

ELEC0557-008 06/01/2023

MIDLAND (Townships of Ingersoll, Jasper, Mount Haley and Porter) & TUSCOLA (Townships of Almer, Arbela, Columbia, Dayton, Denmark, Elkland, Ellington, Elmwood, Fairgrove, Fremont, Gilford, Indianfields, Juniata, Kingston, Koylon, Novesta, Tuscola, Vassar, Watertown and Wells) COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 37.00	23.13

ELEC0665-018 05/31/2024

SHIAWASSEE COUNTY (Townships of Perry & Woodhull)

	Rates	Fringes
ELECTRICIAN	$ 42.98	5.5%+27.39

ELEC0692-017 06/01/2023

ARENAC & GLADWIN COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 36.00	38.03%+9.93

ELEC0692-018 06/01/2022

MIDLAND (All townships except Mount Haley, Jasper, Porter & Ingersoll) & TUSCOLA (Townships of Wisner & Akron) COUNTIES

	Rates	Fringes

ELECTRICIAN.....$ 35.31 38.03%+9.25

ELEC0948-008 11/01/2023

SHIAWASSEE (All townships except Perry & Woodhull) & TUSCOLA (Township of Millington) COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 41.66	10.23+41.26%

ENGI0325-021 09/01/2024

POWER EQUIPMENT OPERATORS: Underground Construction (Including Sewer)

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 43.48	25.25
GROUP 2	$ 38.75	25.25
GROUP 3	$ 38.02	25.25
GROUP 4	$ 37.45	25.25

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Backhoe/ Excavator, Boring Machine, Bulldozer, Crane, Scraper, Loader, Trencher (over 8 ft. digging capacity)

GROUP 2: Trencher (8-ft digging capacity and smaller)

GROUP 3: Boom Truck (non-swinging, non- powered type boom)

GROUP 4: Broom/ Sweeper, Fork Truck, Tractor

ENGI0326-014 06/01/2024

EXCLUDES UNDERGROUND CONSTRUCTION

AREA 1: BRANCH, HILLSDALE, MECOSTA & OSCEOLA COUNTIES

AREA 2: ARENAC, GLADWIN, HURON, MIDLAND, SHIAWASSEE & TUSCOLA COUNTIES

	Rates	Fringes
Operating Engineer:		
AREA 1		
Group 1	$ 47.28	25.25
Group 2	$ 43.93	25.25
Group 3	$ 41.28	25.25
Group 4	$ 39.57	25.25
Group 5	$ 31.23	25.25
Operating Engineers:		
AREA 2		
Group 1	$ 47.28	25.25
Group 2	$ 43.93	25.25
Group 3	$ 41.28	25.25
Group 4	$ 30.57	25.25

Group 5.....$ 31.23 25.25

FOOTNOTES:

Crane operator with main boom and jib 300' or longer: $1.50 per hour above the group 1 rate.
Crane operator with main boom and jib 400' or longer: $3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.

GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick

GROUP 3: Backhoe/Excavator; Bulldozer; Compactor; Crane; Scraper; Loader

GROUP 4: Boom truck (non-swinging)

GROUP 5: Oiler

ENGI0326-024 06/01/2022

EXCLUDES UNDERGROUND CONSTRUCTION

LENAWEE COUNTY

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1	$ 46.44	24.95
GROUP 2	$ 44.94	24.95
GROUP 3	$ 43.44	24.95
GROUP 4	$ 43.14	24.95
GROUP 5	$ 42.32	24.95
GROUP 6	$ 41.46	24.95
GROUP 7	$ 40.49	24.95
GROUP 8	$ 38.78	24.95

FOOTNOTES: Tower cranes: to be paid the crane operator rate determined by the combined length of the mast and the boom.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS

GROUP 1: Crane with boom & jib or leads 400' or longer

GROUP 2: Crane with boom & jib or leads 300' or longer

GROUP 3: Crane with boom & jib or leads 220' or longer

GROUP 4: Crane with boom & jib or leads 140' or longer

GROUP 5: Crane with boom & jib or leads 120' or longer

GROUP 6: Regular crane operator

GROUP 7: Backhoe/Excavator, Bulldozer, Compactor, Scraper, Loader

GROUP 8: Oiler

IRON0025-007 06/01/2024

ARENAC, GLADWIN, HURON, MIDLAND, SHIAWASSEE & TUSCOLA COUNTIES

	Rates	Fringes
IRONWORKER		
Reinforcing	$ 33.43	37.15
Structural	$ 35.55	35.83

IRON0025-016 06/01/2024

BRANCH, HILLSDALE, MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
IRONWORKER (REINFORCING)	$ 35.55	33.14
IRONWORKER (STRUCTURAL)	$ 35.55	33.14

IRON0055-011 07/01/2024

LENAWEE COUNTY

	Rates	Fringes
IRONWORKER, STRUCTURAL AND REINFORCING	$ 35.50	29.20

LABO0334-008 09/01/2022

SCOPE OF WORK:
OPEN CUT CONSTRUCTION: Excavation of earth and sewer, utilities, and improvements, including underground piping/conduit (including inspection, cleaning, restoration, and relining)

ARENAC, BRANCH, GLADWIN, HURON, MECOSTA, MIDLAND, OSCEOLA, TUSCOLA

	Rates	Fringes
LABORER		
(1) Common or General	$ 22.42	12.95
(4) Grade Checker	$ 22.73	12.95

LABO0334-019 09/01/2022

SCOPE OF WORK:
OPEN CUT CONSTRUCTION: Excavation of earth and sewer, utilities, and improvements, including underground piping/conduit (including inspection, cleaning, restoration, and relining)

HILLSDALE, LENAWEE, SHIAWASSEE

	Rates	Fringes
LABORER		

(1) Common or General.....$ 23.39 13.15
(4) Grade Checker.....$ 23.70 13.15

LABO0355-007 06/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

BRANCH COUNTY

	Rates	Fringes
LABORER		
Common or General	$ 26.70	12.95

LABO0355-015 06/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
LABORER		
Common or General	$ 26.70	12.95

LABO0499-014 06/01/2024

EXCLUDES OPEN CUT CONSTRUCTION

HILLSDALE & LENAWEE COUNTIES

	Rates	Fringes
LABORER		
Common or General	$ 31.87	14.45

LABO1075-011 06/01/2024

EXCLUDES OPEN CUT CONSTRUCTION

SHIAWASSEE COUNTY

	Rates	Fringes
LABORER		
Common or General	$ 28.41	15.70

LABO1098-022 07/01/2024

EXCLUDES OPEN CUT CONSTRUCTION

ARENAC, GLADWIN, HURON, MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
LABORER		
Common or General	$ 26.20	13.45

PLAS0016-009 04/01/2014

MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 22.02	12.38

PLAS0016-021 04/01/2014

SHIAWASSEE COUNTY

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 25.58	12.88

PLAS0016-023 04/01/2014

BRANCH COUNTY

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 24.63	12.88

PLAS0016-031 04/01/2014

ARENAC, GLADWIN, HURON, MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 25.47	12.38

PLAS0886-013 08/01/2011

HILLSDALE & LENAWEE COUNTIES

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 27.19	16.00

PLUM0085-017 05/04/2023

ARENAC, GLADWIN, HURON (West of M-53), MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 43.50	22.10

PLUM0098-008 06/01/2019

HURON COUNTY (East of M-53)

	Rates	Fringes
PLUMBER	$ 35.77	35.13

PLUM0174-015 07/01/2020

MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 39.89	23.82

PLUM0190-012 06/01/2021

LENAWEE COUNTY (Townships of Clinton, Macon & Tecumseh)

	Rates	Fringes

PLUMBER/PIPEFITTER.....$ 44.31 23.70

PLUM0333-021 06/01/2022

BRANCH & HILLSDALE COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 42.29	23.94

PLUM0333-022 06/01/2022

LENAWEE COUNTY (Remainder of County)

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 42.29	23.94

PLUM0370-007 06/01/2020

SHIAWASSEE COUNTY

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 39.81	20.95

PLUM0636-008 06/05/2017

HURON COUNTY (East of M-53)

	Rates	Fringes
PIPEFITTER	$ 40.41	29.35

TEAM0007-010 06/01/2024

	Rates	Fringes
TRUCK DRIVER		
Lowboy/Semi-Trailer Truck	$ 32.55	.75 + a+b

FOOTNOTE:
a. $470.70 per week.
b. $68.70 daily.

SUMI2010-042 11/09/2010

	Rates	Fringes
CARPENTER, Excludes Form Work	$ 23.97	6.29
LABORER: Landscape	$ 10.89 **	1.74
LABORER: Mason Tender - Cement/Concrete	$ 15.97 **	3.51
LABORER: Pipelayer	$ 15.28 **	3.99
OPERATOR: Bobcat/Skid Steer/Skid Loader	$ 12.98 **	6.12
OPERATOR: Grader/Blade	$ 15.50 **	3.62
OPERATOR: Roller	$ 13.74 **	7.93

TRUCK DRIVER: Dump Truck.....$ 14.06 ** 1.25

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 ($17.75) or 13658 ($13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

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) (iii)).

The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate 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. The date, 07/01/2024 in the

example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the 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. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination
b) an existing published wage determination
c) an initial WHD letter setting forth a position on a wage determination matter
d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail 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 an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail 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 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.

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END OF GENERAL DECISION"

"General Decision Number: MI20250151 04/11/2025

Superseded General Decision Number: MI20240151

State: Michigan

Construction Type: Building

County: Shiawassee 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)(1).

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 $17.75 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 2025.
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 $13.30 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 2025.

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	01/03/2025
1	01/24/2025

2 02/21/2025
3 04/11/2025

ASBE0047-005 07/01/2024

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 38.00	21.60

BOIL0169-002 01/01/2024

	Rates	Fringes
BOILERMAKER	$ 39.65	35.68

BRMI0009-011 08/01/2024

	Rates	Fringes
BRICKLAYER	$ 38.00	26.49
PLASTERER	$ 34.43	24.44
TILE SETTER	$ 33.31	23.20

FOOTNOTE:

Paid Holiday: Fourth of July, if the worker was employed by the contractor in any period of seven working days before said holiday within the current calendar year.

CARP0706-011 06/01/2024

	Rates	Fringes
CARPENTER (Excluding Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation, and Soft Floor Layer - Carpet)	$ 33.11	23.64

CARP0706-024 06/01/2024

	Rates	Fringes
CARPENTER (Acoustical Ceiling Installation, Drywall Hanging, Form Work, and Metal Stud Installation)	$ 33.71	23.19

CARP1102-003 06/01/2024

	Rates	Fringes
MILLWRIGHT	$ 36.47	40.52

ENGI0324-022 06/01/2024

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1	$ 47.28	25.25
GROUP 2	$ 43.93	25.25
GROUP 3	$ 41.28	25.25

GROUP 4.....$ 39.57 25.25
GROUP 5.....$ 33.71 25.25
GROUP 6.....$ 31.23 25.25

Crane operator with main boom and jib 300' or longer: $1.50 per hour above the group 1 rate.
Crane operator with main boom and jib 400' or longer: $3.00 per hour above the group 1 rate.

PAID HOLIDAYS: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

POWER EQUIPMENT OPERATOR CLASSIFICATIONS
GROUP 1: Crane operator with main boom and jib 400', 300', or 220' or longer.
GROUP 2: Crane operator with main boom and jib 140' or longer, tower crane, gantry crane, whirley derrick
GROUP 3: Backhoe/Excavator; Crane; Loader; Paver; Scraper; Stiff Leg Derrick
GROUP 4: Bobcat/Skid Loader; Fork Truck (over 20' lift)
GROUP 5: Fork Truck (20' lift and under for masonry work)
GROUP 6: Oiler

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* IRON0025-009 04/01/2024

	Rates	Fringes
IRONWORKER, STRUCTURAL (Metal Building Erection Only)	$ 26.59	26.53

IRON0025-010 06/01/2024

	Rates	Fringes
IRONWORKER, REINFORCING	$ 33.43	37.15
IRONWORKER, STRUCTURAL	$ 35.55	35.83

LABO1075-012 06/01/2024

	Rates	Fringes
LABORER		
Common or General; Mason		
Tender - Brick; Mason		
Tender - Cement/Concrete;		
Pipelayer; and Sandblaster	$ 28.41	15.70

PAIN1052-001 05/01/2024

	Rates	Fringes
PAINTER		
Brush & Roler	$ 31.01	17.29
Spray	$ 31.01	17.29

PAIN1052-004 06/01/2024

	Rates	Fringes
DRYWALL FINISHER/TAPER		
Drywall sanding	$ 31.69	17.88
Hand work	$ 27.15	15.00
Machine work	$ 27.15	15.00

PLAS0016-013 04/01/2014

	Rates	Fringes
CEMENT MASON/CONCRETE FINISHER	$ 25.58	12.88

PLUM0370-008 06/01/2023

	Rates	Fringes
PIPEFITTER (Includes HVAC Pipe Installation & Excludes HVAC System Installation)	$ 43.46	22.60
PLUMBER (Excludes HVAC Pipe & System Installation)	$ 43.46	22.60

SFMI0669-003 01/02/2025

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 41.34	27.39

SHEE0007-011 05/01/2023

	Rates	Fringes
SHEET METAL WORKER (Inclduing HVAC Duct & System Installation)	$ 35.19	23.57

* SUMI2011-076 02/14/2011

	Rates	Fringes
FLOOR LAYER: Carpet	$ 19.59	7.57
GLAZIER	$ 16.95 **	4.74
LABORER: Landscape & Irrigation	$ 12.84 **	0.00
OPERATOR: Bulldozer	$ 22.34	1.22
OPERATOR: Grader/Blade	$ 24.04	6.03
OPERATOR: Roller	$ 28.02	7.07
OPERATOR: Tractor	$ 19.60	7.31
ROOFER	$ 15.73 **	7.41
TRUCK DRIVER, Includes Dump and Tandem Truck	$ 15.65 **	3.12
TRUCK DRIVER: Flatbed Truck	$ 16.80 **	3.97

WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Wage and Hour Division
U.S. Department of Labor
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Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

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The request should be accompanied by a full statement of the interested party's position and 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:

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U.S. Department of Labor
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Washington, DC 20210.

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END OF GENERAL DECISION"

Labor Standards Provisions for Federally Assisted Projects - *29 CFR Part 5*

§5.5 Contract provisions and related matters.

(a) The Agency head shall cause or require the contracting officer to insert in full in any contract in excess of $2,000 which is entered into for the actual construction, alteration and/or repair, including painting and decorating, of a public building or public work, or building or work financed in whole or in part from Federal funds or in accordance with guarantees of a Federal agency or financed from funds obtained by pledge of any contract of a Federal agency to make a loan, grant or annual contribution (except where a different meaning is expressly indicated),and which is subject to the labor standards provisions of any of the acts listed in Sec. 5.1, the following clauses (or any modifications thereof to meet the particular needs of the agency, *Provided,* That such modifications are first approved by the Department of Labor):

(1) Minimum wages. (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of paragraph (a)(1)(iv) of this section; also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill, except as provided in Sec. 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: Provided, That the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under paragraph (a)(1)(ii) of this section) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

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

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

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

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

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

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

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

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

(2) *Withholding.* The ***(write in name of Federal Agency or the loan or grant recipient)*** shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the contractor under this contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the

work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the project), all or part of the wages required by the contract, the (Agency) may, after written notice to the contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

(3) *Payrolls and basic records.* (i) Payrolls and basic records relating thereto shall be maintained by the contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(ii)(A) The contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit the payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency). The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead, the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information may be submitted in any form desired. Optional Form WH-347 is available for this purpose from the Wage and Hour Division Web site at dol.gov/agencies/whd/government-contracts/construction/forms or its successor site. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to the (write in name of appropriate federal agency) if the agency is a party to the contract, but if the agency is not such a party, the contractor will submit them to the applicant, sponsor, or owner, as the case may be, for transmission to the (write in name of agency), the contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to the sponsoring government agency (or the applicant, sponsor, or owner).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(b) Contract Work Hours and Safety Standards Act. The Agency Head shall cause or require the contracting officer to insert the following clauses set forth in paragraphs (b)(1), (2), (3), and (4) of this section in full in any contract in an amount in excess of $100,000 and subject to the overtime provisions of the Contract Work Hours and Safety Standards Act. These clauses shall be inserted in addition to the clauses required by Sec. 5.5(a) or 4.6 of part 4 of this title. As used in this paragraph, the terms laborers and mechanics include watchmen and guards.

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

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the clause set forth in paragraph (b)(1) of this section the contractor and any subcontractor responsible there for shall be liable for the unpaid wages. In addition, such contractor and subcontractor shall be

liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in paragraph (b)(1) of this section, in the sum of $10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty hours without payment of the overtime wages required by the clause set forth in paragraph (b)(1) of this section.

(3) Withholding for unpaid wages and liquidated damages. The ***(write in the name of the Federal agency or the loan or grant recipient)*** shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the contractor or subcontractor under any such contract or any other Federal contract with the same prime contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime contractor, such sums as may be determined to be necessary to satisfy any liabilities of such contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in paragraph (b)(2) of this section.

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

(c) In addition to the clauses contained in paragraph (b), in any contract subject only to the Contract Work Hours and Safety Standards Act and not to any of the other statutes cited in Sec.5.1, the Agency Head shall cause or require the contracting officer to insert a clause requiring that the contractor or subcontractor shall maintain payrolls and basic payroll records during the course of the work and shall preserve them for a period of three years from the completion of the contract for all laborers and mechanics, including guards and watchmen, working on the contract. Such records shall contain the name and address of each such employee, social security number, correct classifications, hourly rates of wages paid, daily and weekly number of hours worked, deductions made, and actual wages paid. Further, the Agency Head shall cause or require the contracting officer to insert in any such contract a clause providing that the records to be maintained under this paragraph shall be made available by the contractor or subcontractor for inspection, copying, or transcription by authorized representatives of the Michigan Department of Environment, Great Lakes, and Energy and the Department of Labor, and the contractor or subcontractor will permit such representatives to interview employees during working hours on the job.

Disadvantaged Business Enterprises (DBE) Requirements

Prime contractors bidding on this project must follow, document, and maintain documentation of their Good Faith Efforts (GFE), as listed below, to ensure that Disadvantaged Business Enterprises (DBEs) have the opportunity to participate in the project by increasing DBE awareness of procurement efforts and outreach. Bidders must make the following Good Faith Efforts for any work that will be subcontracted.

1. Ensure DBEs are made aware of contracting opportunities to the fullest extent practicable through outreach and recruitment activities. Place DBEs on solicitation lists and solicit DBEs whenever they are potential sources.

2. Make information on forthcoming opportunities available to DBEs. Arrange timeframes for contracts and establish delivery schedules, where the requirements permit, in a way that encourages and facilitates participation by DBEs in the competitive process. Whenever possible, post solicitation for bids or proposals for a minimum of 30 calendar days before the bid or proposal closing date. The DBEs should be given a minimum of 5 days to respond to the posting.

3. Consider in the contracting process whether firms competing for large contracts can be subcontracted with DBEs. Divide total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by DBEs in the competitive process.

4. Encourage contracting with a consortium of DBEs when a contract is too large for one DBE firm to handle individually.

5. Use the services and assistance of the Small Business Administration and the Minority Business Development Agency of the U.S. Department of Commerce.

Subsequent to compliance with the Good Faith Efforts, the following conditions also apply under the DBE requirements. Completed Good Faith Efforts Worksheets, along with the required supporting documentation outlined in the instructions, must be submitted with your bid proposal. EPA form 6100-2 must also be provided at the pre-bid meeting. A copy of this form is available on the Forms and Guidance page of the EGLE Water Infrastructure Financing Section website.

1. The prime contractor must pay its subcontractor for work that has been satisfactorily completed no more than 30 days from the prime contractor’s receipt of payment from the owner.

2. The prime contractor must notify the owner in writing prior to the termination of any DBE subcontractor for convenience by the prime contractor and employ the Good Faith Efforts if soliciting a replacement contractor.

3. If a DBE contractor fails to complete work under the subcontract for any reason, the prime contractor must employ the Good Faith Efforts if soliciting a replacement contractor.

4. The prime contractor must employ the Good Faith Efforts.

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

Good Faith Efforts Worksheet

Bidder: _____

Subcontract Area of Work (one per worksheet): _____

Outreach Goal: Solicit a minimum of three (3) DBEs via email/letter/fax. It is recommended that various sources be used to locate the minimum number of DBEs. The Michigan Department of Transportation (MDOT) website and www.sam.gov registries may be two resources used to find a minimum of three DBEs.

List the DBEs contacted for the above area of work and complete the following information for each.

Company Name	Type of Contract	Date of Contract	Price Quote Received	Accepted or Rejected	If rejected, explain why

Explanation for Not Achieving a Minimum of Three Contacts; you may include a printout of the MDOT and www.sam.gov search results (attach extra sheets if necessary):

MITA DBE Posting Date (if applicable): _____
(Attach a copy of the DBE advertisement)

Other Efforts (attach extra sheets if necessary):

Please include the completed worksheet and supporting documentation with the bid proposal.

Instructions to Bidders for the Completion of the Good Faith Efforts Worksheet

1. Separate worksheets must be provided for each area of work to be subcontracted out. This includes both major and minor subcontracts.

2. A minimum of three (3) DBEs must be contacted by a verifiable means of communication such as email, letter, or fax for each area of work to be subcontracted out. Copies of the solicitation letters/emails and fax confirmation sheets must be provided with the worksheet.

3. If less than three (3) DBEs exist statewide for the area of work, then provide documentation that other DBE resources were consulted. This may include the MDOT and www.sam.gov registries and an advertisement in a publication. A printout of the website searched (conducted prior to the end of the bid period) must be submitted.

4. Posting solicitations for quotes/proposals from DBEs on the MITA website (www.mitadbe.com) is highly recommended to facilitate participation in the competitive process whenever possible. The solicitation needs to identify the project and the areas of work to be subcontracted out. A copy of the MITA DBE advertisement must be submitted with the Good Faith Efforts worksheet, if used, or a printout of the resulting quotes posted to the MITA website can be submitted with this form as supporting documentation.

5. If the area of work is so specialized that no DBEs exist, then an explanation is required to support that conclusion, including the documentation required in No. 3 above.

6. The date of the DBE contact must be identified, as it is important to document that the DBE solicitation was made during the bid period and that sufficient time was given for the DBE to return a quote.

7. Each DBE firm's price quote must be identified if one was received, or N/A entered on the worksheet if a quote was not received. Copies of all quotes must be submitted with the worksheet.

8. If a quote was received, indicate if it was accepted or rejected. Justification for not accepting a quote and not using the DBE subcontractor must be provided.

9. Under Other Efforts, please indicate additional steps you have taken to obtain DBE contractors and provide the appropriate supporting documentation such as:

    - Follow-up emails, faxes, or letters.
    - Copies of announcements/postings in newspapers, trade publications, or minority media that target DBE firms.

Disadvantaged Business Enterprise (DBE) and Good Faith Efforts (GFE) Requirements
Frequently Asked Questions Regarding Contractor Compliance

Q: What is the Good Faith Efforts Worksheet and how is it completed?
A: The worksheet captures efforts by the prime contractor to solicit DBEs for each area of work type that will be subcontracted out. A separate GFE Worksheet must be provided by the prime contractor for each area of work type to be subcontracted out. There are specific instructions that accompany the worksheet that prescribe minimum efforts which bidders must make in order to be in compliance with the DBE requirements.

Q: Can non-certified DBEs be used?
A: While non-certified DBEs can be used, only DBEs, MBEs, and WBEs that are certified by EPA, SBA, or MDOT (or by tribal, state and local governments, as long as their standards for certification meet or exceed the standards in EPA policy) can be counted toward the fair share goal. Proof of certification by one of these recognized and approved agencies should be sought from each DBE.

Q: How does a DBE get certified?
A: Applications to be certified by MDOT can be found at mdotjboss.state.mi.us/MUCPWeb/eligibilityRequirements.htm
To register with the U.S. Small Business Association visit sba.gov/federal-contracting/contracting-assistance-programs/small-disadvantaged-business
To be certified by EPA, a DBE must first have sought certification through SBA, MDOT, or a tribal, state, or local organization and be unsuccessful in that attempt.

Q: If a bidder follows the MDOT DBE requirements, will the bidder comply with the SRF DBE requirements?
A: No. Federally funded highway projects utilize DBE goals, which require a certain percentage of work be performed by DBE subcontractors. For SRF projects, there is no financial goal. However, there is a solicitation effort goal. Bidders must use Good Faith Efforts for each and every area of work to be subcontracted out to obtain DBEs. The bidders are not required to use DBEs if the quotes are higher than non-DBE subcontractors. There is no required DBE participation percentage contract goal for the SRF. However, if the SRF project is part of a joint project with MDOT, the project can be
excluded from SRF DBE requirements (i.e., the Good Faith Efforts Worksheet is not required) as it would be difficult to comply with both programs' requirements.

Q: Should the Good Faith Efforts Worksheet and supporting documentation be submitted with bid proposals?
A: Yes. This is a requirement to document that the contractor has complied with the DBE requirements and GFE. These compliance efforts must be done during the bidding phase and not after-the-fact. It is highly recommended that the need for these efforts and the submittal of the forms with the bid proposals be emphasized at the pre-bid meeting. Failure to show that the Good Faith Efforts were complied with during the bidding process can lead to a prime contractor being found non-responsive.

Q: What kinds of documentation should a contractor provide to document solicitation efforts?
A: Documentation can include fax confirmation sheets, copies of solicitation letters/emails, printouts of online solicitations, printouts of online search results, affidavits of publication in newspapers, etc.

Q: What if no forms are turned in with the bid proposal or forms are blank or incomplete? Should this be cause to determine that the bidder is non-responsive?
A: While the Good Faith Efforts Worksheet is important, it is more critical to confirm that the contractor complied with the DBE requirements prior to bid opening. The owner should contact the bidder as soon as deficiencies are noted for documentation of efforts taken to comply with the DBE requirements. Immediate submittal of the completed forms will be acceptable provided the Good Faith Efforts were made and it is just a matter of transferring information to the forms.

Q: How much time will compliance with GFE require in terms of structuring an adequate bidding period?
A: Due to the extent of the efforts required, a minimum of 30 calendar days is recommended between bid posting and bid opening to ensure adequate time for contractors to locate certified DBEs and solicit quotes.

Q: How does a contractor locate certified DBEs?
A: MDOT has a directory of all Michigan certified entities located at mdotjboss.state.mi.us/MUCPWeb/. Additionally, the federal System for Award Management (SAM) is another place to search and can be found at sam.gov. SAM contains information from the former Central Contractor Registration (CCR) database.

Q: If the bidder does not intend to subcontract any work, what forms, if any, must be provided with the bid proposal?
A: The bidder should complete the Good Faith Efforts Worksheet with a notation that no subcontracting will be done. However, if the bidder is awarded the contract and then decides to subcontract work at any point, then the Good Faith Efforts must be made to solicit DBEs.

Q: If the prime contractor is a DBE, does he have to solicit DBE subcontractors?
A: Yes, the DBE requirements still apply if the prime intends to subcontract work out. GFE must be used to solicit DBEs.

Q: If the area of work is one where there are less than three DBE contractors, how is the contractor to document this?
A: Copies of printouts from MDOT and SAM showing no DBEs and advertisements soliciting quotes for all subcontract areas, including the questionable areas, will be adequate if the dates on the printouts are prior to the bid or proposal closing date.

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

Certification Regarding Debarment, Suspension, and Other Responsibility Matters

The prime contractor must provide a completed *Certification Regarding Debarment, Suspension, and Other Responsibility Matters Form* with its bid or proposal package to the owner.

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

(1) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participation in transactions under federal nonprocurement programs by any federal department or agency;

(2) Have not, within the three-year period preceding the proposal, had one or more public transactions (federal, state, or local) terminated for cause or default; and

(3) Are not presently indicted or otherwise criminally or civilly charged by a government entity (federal, state, or local) and have not, within the three-year period preceding the proposal, been convicted of or had a civil judgment rendered against it:

   (a) For the commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public transaction (federal, state, or local) or a procurement contract under such a public transaction;

   (b) For the violation of federal or state antitrust statutes, including those proscribing price fixing between competitors, the allocation of customers between competitors, or bid rigging; or

   (c) For the commission of embezzlement, theft, forgery, bribery, falsification, or destruction of records, making false statements, or receiving stolen property.

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

_____

Name and Title of Authorized Representative

_____

Name of Participant Agency or Firm

_____

Signature of Authorized Representative Date

☐ I am unable to certify to the above statement. Attached is my explanation.

SECTION 01 11 00 – SUMMARY OF WORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work covered by the Contract Documents comprises furnishing and installation of all work located at 1410 Chippewa Trail for City of Owosso, Owner.

B. The Work includes the following major items:

C. Remove two existing well house buildings entirely, well and well pump to remain/protect. Construction new well house buildings over top of two existing wells to include all electrical, HVAC. A third well is to be abandoned, remove existing building and all above grade items.

1.3 TYPE OF CONTRACT

A. Construct the Work of this Contract under a single lump sum Contract.

1.4 GENERAL

A. Imperative Language: These Specifications (Divisions 01 through 49) are written in the imperative and abbreviated form. This imperative language of the technical specifications is directed at Contractor unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall", "shall be" and similar mandatory phrases by inference in the same manner as they are applied to notes on Drawings. The words "shall", "shall be" and similar mandatory phrases shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, fulfill (perform) all indicated requirements whether stated in the imperative or otherwise.

B. Related Sections: Some Sections of these Specifications (Divisions 01 through 49) may include a paragraph titled "Related Sections". This paragraph is an aid to the Project Manual user and is not intended to include all Sections which may be related. It is Contractor's obligation to coordinate all Sections whether indicated under "Related Sections" or not.

C. Reference to the General Conditions: In Divisions 01 through 49, a reference to the General Conditions includes by inference all amendments or supplements in the Supplementary Conditions.

1.5 CONTRACTOR USE OF PREMISES

A. Limit use of premises to allow for Owner occupancy and work by other contractors.

B. Limit construction traffic access to Site from North entrance.

C. Coordinate use of premises under direction of the Owner.

D. Where the Contract Documents identify certain site elements within the construction limits, such as sidewalks, drives, and streets, that must be kept open for public or the Owner’s use during construction, the Contractor shall be responsible for protection and maintenance of such elements as well.

E. Except in connection with the safety or protection of persons or the Work or property at the Site or adjacent thereto, all Work at the site shall be restricted to the following hours:
   1. Monday Through Friday (Except Legal Holidays): 7:30 a.m. to 5 p.m.
   2. Saturday, Sundays, or legal holidays with written approval of the Owner.

1.6 OCCUPANCY REQUIREMENTS

A. Owner Occupancy During Construction:
   1. The Owner will occupy or utilize premises during entire period of construction for conduct of the Owner's normal operations. Cooperate with the Owner and Engineer to minimize conflict and to facilitate the Owner's operations.
   2. Access to Abutting Properties: Provide at all times.
   3. Access for Emergency Vehicles:
      a. Provide at all times.
      b. Provide at least one clear lane during nonwork periods.
   4. Access to Filter Room:
      a. Contractor access to the Filter Room shall be limited to the north exterior access door, located immediately east of the Filter Room.
      b. Protect existing roof of filters.
   5. Fire Hydrants: Provide access to at all times.
   6. Do not block fire access routes.
   7. Detours and Street Closure:
      a. When provided for in the Contract Documents or approved by the Engineer.
      b. Routes and barricades as indicated or as approved by road authority.
   8. Construct Work so as to not interfere with Owner operations in accordance with this Section.
      a. Sequence Work to avoid plant shutdowns to the extent possible. Plant shutdowns required for the Work shall be minimized to the greatest extent possible and shall be limited to a maximum of 4 hours per event. All proposed plant shutdowns are subject to the approval of the Owner. Provide a minimum of 30 days notice to the Owner for requested plant shutdowns.
      b. One gravity filter shall be taken out of service at a time, unless otherwise approved by Owner.
      c. Work shall be completed in 4 phases, one phase for each filter. All work within each filter shall be completed within the respective phase.
      d. During each phase, the filter under construction shall be fully isolated from the remaining filters with a temporary air-tight enclosure. Provide ventilation and heating for the temporary enclosure through the exterior wall adjacent to respective filter.
      e. Do not remove an additional filter until the previous filter is fully installed, tested, disinfected, and approved for use by Owner, Engineer, and Manufacturer's representative.
      f. Access to the site for chemical deliveries must be maintained at all times.
   9. Limit parking for construction vehicles to an area designated by the Owner.

1.7 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner and Engineer.

B. Sequence Submittal:
   1. The sequence indicated below is offered as a suggestion to the Contractor.
   2. Submit a proposed sequence with appropriate times of starting and completion of tasks to Engineer for review.

C. The following sequence and intermediate dates are suggested to accommodate Owner's occupancy requirements during the construction period:
   1. complete one well house and place back into service before starting on second well house.

1.8 PARTIAL UTILIZATION AND SUBSTANTIAL COMPLETION

A. Schedule and substantially complete the following designated portions of Work for Owner's occupancy or utilization prior to Substantial Completion of entire Work:
   1. Obtain certificate of Substantial Completion for each designated portion of Work prior to Owner occupancy.

1.9 SALVAGED MATERIALS

A. Ownership:
   1. Owner shall have the option of retaining ownership of any or all existing equipment, materials, and items removed under this Work.
   2. Should Owner decide not to retain ownership of certain items removed under the Work of this Section, those items shall become property of Contractor and shall be promptly removed from the Project Site.

B. Delivery: Deliver items which remain property of Owner to a location, or locations, as selected by the Owner and on Site.

PART 2 - PRODUCTS

2.1 OTHER MATERIALS

A. General: All other materials which are not specified herein and are not indicated on the Drawings, but are required for proper and complete performance of the Work.

B. Procedure:
   1. Select new, first quality material.
   2. Obtain Engineer's review.
   3. Provide and install.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 11 00

SECTION 01 12 23 – STAKING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes staking and inspection services to be provided by contractor and others.

1.3 PROJECT LAYOUT

A. Responsibilities:
   1. Engineer will furnish stakes as follows:
      a. For Wastewater and Storm Sewers, Line and Grade Stakes:
         1) At manhole.
         2) At 50, 100, 200 and 300 feet upstream from manholes.
         3) At mid-point between manholes.
      b. For Water Mains and Pumping Mains, Line Stakes:
         1) At intervals of approximately 300 feet.
         2) At other locations generally required to aid the construction.
         3) Grades will be established at critical locations only.
      c. For Street, Line and Grade Stakes:
         1) At intervals of 50 feet.
         2) At all point of intersection, point of curvature and side street centerlines.
         3) As needed at critical locations.
   2. Provide Engineer 3 working days notice to schedule staking.

B. Expense:
   1. Staking described above will be authorized by and paid for by Owner.
   2. Restaking or staking in excess of that described above will be at the expense of Contractor.

1.4 CONSTRUCTION INSPECTION

A. By Fishbeck:
   1. Visits to the Site: In accordance with the General Conditions.
   2. Expense: Paid by Owner with amounts for additional inspection costs deducted from payment or payments to Contractor in accordance with Division 01 Section “Closeout Procedures.”

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 12 23

SECTION 01 21 13 – CASH ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section provides for cash allowances which are included in the Contract Price.

B. Related Sections include Sections in Divisions 01 through 49, as identified below, provide additional information on what is covered by the respective allowances.

1.3 SCHEDULE OF ALLOWANCES

A. Include in the Contract Price the following amounts:
   1. The amount of $50,000 for special inspection and testing indicated in Division 01 Section “Special Inspections and Tests.”

1.4 CASH ALLOWANCES

A. Costs Associated With Allowances:
   1. All costs, associated with allowances, which are not specifically defined in the Schedule of Allowances, paragraph 1.3 of this Section shall be included in the Base Bid.
   2. Associated costs not specifically defined in the Schedule of Allowances may include, but are not necessarily limited to:
      a. Unloading.
      b. Handling on the Site.
      c. Labor.
      d. Installation.
      e. Overhead.
      f. Profit.

1.5 ADJUSTMENT OF COSTS

A. Change Order: To adjust Contract Price if final cost is different from allowance.

B. Documentation:
   1. Submit:
      a. Within 60 days after completion of the work under the allowance.
      b. Documentation of actual costs.
   2. Failure to submit claims within the designated time will constitute a waiver of claims for additional costs.
   3. At Contract closeout, reflect all approved changes in Contract amounts in the final statement of accounting.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 21 13

SECTION 01 25 13 – PRODUCT SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the administration of substitutions and Product options.

1.3 SUBMITTALS

A. List of all products proposed for installation:
   1. Submit 5 copies within 30 days after the Effective Date of Agreement unless otherwise indicated elsewhere in the Contract Documents.
   2. Tabulate the list by each Specification Section.

1.4 CONTRACTOR'S OPTIONS

A. Products specified only by reference standards or by description:
   1. Select any Product meeting the standards or description by any Supplier unless otherwise required elsewhere in the Contract Documents.
   2. Submit for Engineer's review:
      a. Name and address of Supplier.
      b. Trade name.
      c. Model or catalog designation.
      d. Manufacturer's data including:
         1) Performance and test data
         2) Compliance with reference standards.

B. Products specified by naming one or more suppliers without an "or equal" clause:
   1. Use specified Product of one of the Suppliers named.
   2. No substitutions.

C. Products specified by naming one or more suppliers with an "or equal" clause:
   1. Indicates the option of selecting equivalent Products by stating "or equal" after the specified Suppliers.
   2. Engineer may waive some or all of the requirements specified for substitutions if, at Engineer's sole discretion, the proposed equivalent Product is considered an "or equal".
   3. If, at Engineer's sole discretion, the proposed equivalent Product does not qualify as an "or equal", it will be considered as a proposed substitute and a substitution request submittal will be required.

1.5 SUBSTITUTIONS

A. Substitutions after the effective date of agreement:
   1. Within 30 days after the Effective Date of Agreement.
   2. Engineer will consider formal requests for substitution of Products in place of those specified unless otherwise prohibited elsewhere in the Contract Documents.

B. Substitution Request Submittals: Submit 5 copies of the request for substitution including the following:
   1. Complete data substantiating compliance of the proposed substitution with the Contract Documents.
   2. For Products:
      a. Names and addresses of Manufacturer and Supplier.
      b. Product identification.

c. Manufacturer's literature, including:
   1) Product description.
   2) Performance and test data
   3) Reference standards.
d. Samples.
e. Name and address of similar projects on which the Product was used and date of installation.

3. For Construction Methods:
   a. Detailed description of the proposed method.
   b. Drawings illustrating methods.
4. Itemized comparison of proposed substitution with Product or method specified.
5. Data relating to changes in the construction schedule.
6. Accurate cost data on the substitution and comparison with the Product or method specified.
7. Changes to the Work which would be caused by the substitution.

C. Contractor's Responsibilities: In making a request for a substitution, Contractor represents:
1. Contractor has personally investigated the proposed Product or method and determined that it is equal or superior in all respects to that which is specified.
2. Contractor will provide the same guarantee for the substitution as for the Product or method specified.
3. Contractor will coordinate installation of the accepted substitution into the Work making such changes as may be required for the Work to be completed in all respects.
4. Contractor waives all claims for additional cost related to the substitution which consequently become apparent.
5. Cost data is complete and includes all related costs under Contractor's contract, but excludes costs under separate contracts and Engineer's redesign costs.

D. Substitutions Not Considered: Substitutions will not be considered if:
1. They are indicated or implied on Shop Drawings or Product data submittals without formal request submitted in accordance with this Section.
2. Acceptance will require substantial revision of the Contract Documents.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 25 13

SECTION 01 29 73 – SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes preparation and submittal of a schedule of values.

1.3 GENERAL

A. Timing of Submittal: Submit to Engineer a schedule of values allocated to the various portions of the Work, within 10 days after the Effective Date of the Agreement.

B. Supporting Data: Upon request of Engineer, support the values with data which will substantiate their correctness.

C. Use of Schedule: The schedule of values, unless objected to by Engineer, shall be used only as the basis for the Contractor's Applications for Payment.

1.4 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Form and Identification:
   1. Type schedule on 8-1/2-inch x 11-inch white paper.
   2. Contractor's standard forms and automated printout may be used.
   3. Identify Schedule with:
      a. Title of Project and location.
      b. Engineer.
      c. Project number.
      d. Name and address of Contractor.
      e. Contract designation.
      f. Date of submission.

B. Detail: Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Format:
   1. Follow the Table of Contents of this Project Manual as the format for listing component items.
   2. Identify each line item with the number and title of the respective major Section of the Specifications.

D. Subvalues: For each major line item list subvalues of major Products or operations under the item.

E. Allowances:
   1. Include in each line item the amount of the respective allowances specified in Division 01 Section “Cash Allowances.”
   2. For unit cost allowances, give quantities measured from Contract Documents multiplied by the unit cost equal to the total cost for the item.

F. Change Orders: For each Application for Payment, revise schedule to list Change Orders.

G. For the various portions of the Work:
   1. Each item shall include a directly proportional amount of Contractor's overhead and profit.
   2. For items on which progress payments will be requested for stored materials, break down the value into:
      a. The cost of the materials, delivered and unloaded, with taxes paid.
      b. The total installed value.

H. The sum of all values listed in the schedule shall equal the total Contract Price.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 29 73

SECTION 01 31 13 – PROJECT COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for coordination of the Work.

1.3 GENERAL COORDINATION

A. Coordinate scheduling, submittals and work of the various Sections of the Specifications to:
   1. Ensure efficient and orderly sequence of installation of interdependent construction elements.
   2. Provide for items to be installed later.

B. Interrelated Operating Equipment:
   1. Verify that characteristics of elements are compatible.
   2. Coordinate work of various sections having interdependent responsibilities for:
      a. Installation.
      b. Connection.
      c. Placing in service.

C. Space Coordination Between the Trades:
   1. General:
      a. Coordinate the layout and space requirements of all trades including but not limited to:
         1) Mechanical.
         2) Plumbing.
         3) Fire protection.
         4) Lighting.
         5) Electrical distribution system.
         6) Communication network.
         7) Process piping.
         8) Structural systems.
   2. Drawings:
      a. The Drawings of the following system are diagrammatic and not to scale. Each trade shall use required offsets, bends, and special connections, which are not necessarily indicated on the Drawings, but which are required for proper installation:
         1) Mechanical.
         2) Electrical distribution.
         3) Communication network.
         4) Process piping.
      b. Follow the routing diagrammatically indicated in the Drawings as closely as practical.
   3. Ceiling Space:
      a. Coordinate the sequence and exact routing of all components installed above the ceiling or at a clearance point.
      b. Take into consideration sloping requirements of continuous runs of systems.
   4. Space Utilization and Accessibility:
      a. Utilize space efficiently to maximize accessibility for:
         1) Other systems.
         2) Maintenance.
         3) Repairs.
   5. Layout: Layout systems parallel with lines of the building.

6. Shop Drawings: Carefully review and revise the Shop Drawings from the various trades to ensure that space requirements for all systems are coordinated.
7. Additional Payments: No additional payments will be made by Owner due to location adjustments of systems or installations of offsets, bends, and special connectors necessary for proper installation.

D. In finished areas, except as otherwise indicated:
1. Conceal pipes, ducts and wiring in the construction.
2. Coordinate locations of fixtures and outlets with finish elements.

1.4 ACCEPTANCE OF CONDITIONS

A. Inspection:
1. Prior to performing any work under a section:
a. Carefully inspect the installed work.
b. Verify that all such work is complete to the point where the work under that Section may properly commence.
c. Starting of work indicates acceptance of the condition of components to which the work will be applied.
2. Verify that all materials, equipment and Products to be installed under a Section may be installed in strict accordance with the original design and reviewed Shop Drawings.

B. Discrepancies:
1. Resolve all discrepancies and conflicts between the trades.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

1.5 SLEEVES AND INSERTS

A. Function: For pipes, conduits and similar items in forms, walls, partitions, and floors.

B. Trades: Furnish required sleeves and inserts.

C. Place sleeve and inserts in ample time so as to not delay work.

D. Except as approved by Engineer, do not place sleeves vertically through:
1. Beams.
2. Girders.
3. Similar construction.

E. Maintain in proper position during subsequent work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 31 13

SECTION 01 31 19 – PROJECT MEETINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes scheduling and administering of preconstruction and progress meetings.

B. Scheduling and Administration of Meetings:
   1. Responsibility:
      a. Preconstruction Meeting: Engineer.
      b. Progress Meetings: Contractor.
   2. Procedures:
      a. Prepare agenda.
      b. Distribute written notice and agendas of meetings 4 days in advance of the meeting date.
      c. Make physical arrangements for the meetings.
      d. Preside at meetings.
      e. Record minutes and include significant proceedings and decisions.
      f. Distribute copies of the minutes within 4 days after meetings to:
         1) Participants.
         2) Others affected by proceedings.

1.3 PRECONSTRUCTION MEETING

A. Schedule: Preconstruction meeting will be scheduled by Engineer:
   1. Within 20 days after the Effective Date of Agreement.
   2. Before starting the Work at the Site.

B. Attendance: Representatives of the following parties are to be in attendance at the meeting:
   1. Owner.
   2. Engineer.
   3. Contractor.
   4. Major Subcontractors.
   5. Governmental or regulatory agencies when appropriate.
   6. State of Michigan, EGLE

1.4 PROGRESS MEETINGS

A. Types of Progress Meetings:
   1. Regular.
   2. Called.
   3. Preinstallation.

B. Schedule meetings as follows unless otherwise approved by Engineer:
   1. Regular.
   2. Called: As the progress of the Work dictates.
   3. Preinstallation: At least 7 working days prior to start of installation.

C. Location: Hold meetings at 1401 Chippewa Trail or as indicated in the notice.

D. Attendance: Representatives of the following parties are to be in attendance at the meeting:
   1. Engineer.
   2. Contractor.
   3. Major Subcontractors as pertinent to the agenda.
   4. Owner's representative as appropriate.
   5. Governmental or other regulatory agencies as appropriate.

E. Minimum Agenda: The minimum agenda for progress meetings shall consist of the following:
   1. Review and approve minutes of previous meetings.
   2. Review progress of the Work since the previous meeting.
   3. Note field observations, problems and decisions.
   4. Identify problems which impede planned progress.
   5. Review offsite fabrication problems.
   6. Develop corrective measures and procedures to regain plan schedule.
   7. Revise construction schedule as indicated.
   8. Review submittal schedules; expedite as required to maintain schedule.
   9. Maintenance of quality and work standards.
   10. Review changes proposed by Owner for their effect on the construction schedule and completion date.
   11. Identify all claims and potential claims.
   12. Pending changes and substitutions.
   13. Complete other current business.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 31 19

SECTION 01 32 16 – CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the preparation, furnishing, distribution and periodic revision of construction progress schedules.

PART 2 - PRODUCTS

2.1 FORM OF SCHEDULE

A. Preparation:
   1. Prepare in the form of a horizontal bar chart, CPM network, or other form as previously approved by Engineer.
   2. Provide a separate horizontal bar column or path for each trade or operation.
   3. Prepare the schedule in the chronological order of the beginning of each item of work.
   4. Identify each column or path by:
      a. Major Specification Section number.
      b. Distinct graphic delineation.
   5. Use a horizontal time scale and identify the first work day of each week.
   6. Allow space for updating.

B. Size: The schedule sheets shall be 11 inches x 17 inches unless otherwise approved by Engineer.

2.2 CONTENT OF SCHEDULES

A. Construction Sequence:
   1. Provide a complete sequence of construction by activity identifying work of separate stages.
   2. For Shop Drawings, project data and Samples indicate the following:
      a. Submittal dates.
      b. Dates review copies will be required.
   3. Show decision dates for selection of finishes.
   4. Show Product procurement and delivery dates.
   5. Show dates for beginning and completion of each element of construction.

B. Percentage Completion: Show the projected percentage of completion for each item of work as of the first day of each month.

C. Subschedules:
   1. Provide separate subschedules showing submittals, review times, procurement schedules and delivery days.
   2. Provide subschedules to define critical portions of the entire schedule.

PART 3 - EXECUTION

3.1 SUBMITTALS

A. Preliminary Schedule:
   1. Submit the preliminary schedule within 10 days after the Effective Date of Agreement.
   2. Engineer will review schedules and will return the reviewed copy within 15 days after receipt.

3. If required, resubmit within 7 days after receipt of a returned review copy.
4. Meet with Engineer at least 10 days prior to the submission of the first Application for Payment to review the schedule.

B. Periodic Adjustment: Monthly, submit a revised schedule accurately depicting adjustments and progress to the first day of each month.

C. Number of Copies: Submit the number of copies required by Contractor, plus 4 copies to be retained by Engineer.

3.2 DISTRIBUTION

A. Reviewed Schedules: Distribute copies of the reviewed schedules to the following:
1. Job Site file.
2. Subcontractors.
3. Other concerned parties.

B. Instructions to Recipients: Instruct recipients to report all inability to comply with the schedule, and provide detailed explanations with suggested remedies.

3.3 ADJUSTMENT OF PROGRESS SCHEDULE

A. Changes: Show all changes occurring since previous submission of the schedule.

B. Progress: Indicate progress of each activity and show completion dates.

C. Other Items:
1. Include major changes in scope.
2. Include activities modified since previous updating.
3. Include revised projections due to changes.
4. Include other identifiable changes.

D. Narrative Report: Provide a narrative report including:
1. A discussion of problem areas including current and anticipated delay factors and their impact.
2. Direct action taken, or proposed, and its effect.
3. A description of revisions including:
   a. Their effect on the schedule due to change of scope.
   b. Revisions in duration of activities.
   c. Other changes that may affect the schedule.

END OF SECTION 01 32 16

SECTION 01 32 26 – CONSTRUCTION PROGRESS REPORTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the preparation, submittal, furnishing and distribution of daily construction reports.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 GENERAL

A. Obtain 1 original copy from Engineer prior to the start of construction and make sufficient copies for Contractor's use.

B. Complete a Daily Construction Report form for each day on which work occurs at the Site.

C. Keep completed forms in a binder on the Site.

D. Make completed forms in binder available for Owner's and Engineer's review upon request.

3.2 SCHEDULES

A. Attached is a Daily Construction Report form.

DAILY CONSTRUCTION REPORT
OWNER: City of Owosso, Michigan
PROJECT TITLE: Well Improvements

Weather _____ Page 1 of ___

Temperature _____ Date: _____

Time on site _____ Contractor: _____

CONTRACTOR'S LABOR FORCE	Supervision	Carpenters	Laborers	Other	TOTAL
	_____	_____	_____	_____	_____

Subcontractors

WORK BEING _____

PERFORMED and _____

MAJOR DELIVERIES _____

Use other side for _____

additional information _____

_____

_____

_____

_____

_____

DISCUSSIONS or _____

DECISIONS _____

_____

VISITORS _____

_____

BY:_____ TITLE: _____

END OF SECTION 01 32 26

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedures for the submittal of Shop Drawings, Product Data, Samples, Operation and Maintenance Manuals, and other information.

B. Related Sections include pertinent Sections of these Specifications for the individual Submittals required.

1.3 DEFINITIONS

A. Submittal: Information sent by Contractor to convey information about systems, equipment, materials, products, and administrative matters for the Work.

B. Resubmittal: Submittal sent for review a second or further time.

C. Product Data: Illustrations, standard schedules, diagrams, performance charts, instructions, brochures, or manufacturer's literature that describe the physical size, appearance, and other characteristics of materials or equipment for a portion of the Work.

D. Shop Drawings: Drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

E. Samples: Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.

F. Action Submittals: Submittals that require Engineer's response.

G. Informational Submittals: Submittals that do not require Engineer's response.

H. Delegated-Design: In certain individual Specification Sections, design services or certifications by a design professional that are specifically delegated to the Contractor. Performance and design criteria are defined in the individual Specification Sections or on the Drawings. Contractor is solely responsible for design of those items or systems, coordination of the design with the balance of the Project, and achieving specified performance.

I. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format. All PDF files shall be searchable.

1.4 SUBMITTAL PROCEDURES

A. Submittal Schedule:
   1. Prepare and submit a Submittal schedule that identifies the following for each Submittal:
      a. Submittal number
      b. Submittal description
      c. Projected date Submittal will be submitted.
   2. An electronic copy (MS Excel file) of a blank Submittal schedule, in the preferred format, will be furnished by Engineer at the preconstruction meeting.

3. Submittal Numbers:
   a. Use the applicable Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.1).
   b. Resubmittals shall include a letter suffix after another decimal point (e.g., 06 10 00.1.A).
   c. Submittals that are not numbered correctly may be rejected.

B. Delivery Method:
   1. Web-Based Collaboration and Document Sharing System:
      a. A web-based collaboration and document sharing system may be utilized at Contractor's, Owner's, or Engineer's option.
      b. Use of such a system will be discussed during the preconstruction meeting.
      c. All parties must agree on use of a web-based collaboration and document sharing system.
      d. Training and licensing will be provided for all parties by the party suggesting use of a web-based collaboration and document sharing system.
   2. Where a web-based collaboration and document sharing system is not utilized, Submittals may be delivered as paper copies or electronic files at Contractor's option; except for Operation and Maintenance Manuals, which shall be delivered as specified herein.
   3. Advise Engineer and Owner of delivery method to be used at the preconstruction meeting.
   4. Where Submittals include information that is intended to be printed on sheets larger than 11 inches x 17 inches, or where scale or drawing size are critical for proper review, submit 2 paper copies for review.
   5. Paper Copies:
      a. Unless indicated otherwise, submit 2 copies of each Submittal.
      b. One copy of each Action Submittal will be returned to Contractor.
      c. Extra copies submitted by Contractor will be discarded.
   6. Electronic Files:
      a. Unless indicated otherwise, submit 1 copy of each Submittal in PDF format.
      b. Scanned Submittals shall be produced in such a way as to not compromise the graphic quality or accuracy of scale, where applicable; and text shall be searchable.
      c. One copy of each Action Submittal will be returned to Contractor.
      d. Transmit Submittals via electronic mail (e-mail) or web-based collaboration and document sharing system, where used. Submittals that are transmitted electronically will be returned electronically.
   7. Transmit Submittals to party and address identified by Engineer at preconstruction meeting.

C. Coordination and Timing: Coordinate preparation and processing of Submittals with performance of construction activities. Contractor is responsible for cost of delays caused by lack of coordination or tardiness of Submittals. Incomplete Submittals will be rejected.
   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 parts of the Work so processing will not be delayed because of need to review Submittals concurrently for coordination.
      a. Engineer reserves the right to withhold action on a Submittal requiring coordination with other Submittals until related Submittals are received.

D. Processing Time: Allow 15 full working days for Engineer to review each Submittal, including Resubmittals. Time for review shall commence on Engineer's receipt of Submittal. No extension of the Contract Time will be authorized because of failure to transmit Submittals enough in advance of the Work to permit processing, including Resubmittals. Engineer will advise Contractor when a Submittal being processed must be delayed for coordination.

E. Identification: Place a permanent label on each Submittal or generate a separate cover sheet.
   1. Indicate name of firm or entity that prepared Submittal.
   2. Provide space to record Contractor's review and approval markings and action taken by Engineer.
   3. Include the following information:
      a. Project name.
      b. Date.
      c. Name and address of Engineer.
      d. Name and address of Contractor.
      e. Name and address of Subcontractor(s).
      f. Name and address of Supplier(s).
      g. Name of Manufacturer.

h. Submittal number, including revision identifier.
i. Drawing number and detail references, as applicable.
j. Location(s) where product is to be installed, as applicable.
k. Other necessary identification.

F. Deviations: Encircle or otherwise specifically identify deviations from the Contract Documents on Submittals. Submittals that include deviations that are not identified may be rejected. Engineer may or may not consider deviations. Deviations are not substitutions. Refer to Division 01 Section “Product Substitution Procedures” for procedures regarding requests for substitutions.

G. Transmittal: Package each Submittal individually and appropriately for transmittal and handling. Transmit each Submittal using a transmittal form. Engineer will reject Submittal(s) received from sources other than Contractor.

H. Resubmittals: Make Resubmittals in same form and number of copies as initial Submittal.
1. Note date and content of previous Submittal.
2. Clearly identify additions and revisions.
3. Resubmit Submittals until they are marked, “Reviewed, No Exceptions Noted” or “Reviewed With Corrections Noted.”

I. Distribution: Furnish copies of Submittals with mark indicating, “Reviewed, No Exceptions Noted” or “Reviewed With Corrections Noted,” to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.

J. Use for Construction: Unless otherwise indicated by Engineer, use only Submittals with mark indicating, “Reviewed, No Exceptions Noted” or “Reviewed With Corrections Noted.”

1.5 CONTRACTOR'S USE OF ENGINEER’S ELECTRONIC DRAWING FILES

A. At Contractor's written request, copies of Engineer’s electronic Drawing files may be provided to Contractor for Contractor's use in connection with Project, including Submittal preparation. Electronic files may be furnished by Engineer for the convenience of the Contractor. Conclusions or information obtained or derived from such electronic files will be at the Contractor’s sole risk. Materials furnished by Engineer that may be relied upon are limited to printed Contract Documents.

B. When Contractor uses Engineer’s electronic Drawing files to facilitate Submittal preparation, prepare Submittals to be project specific. Submittals that are not project specific, including Engineer’s Drawing files submitted on a new title block, will be rejected.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit project specific Action Submittals required by individual Specification Sections. Do not use highlighting that would not be reproducible. Include a table of contents or index with each Submittal. As part of electronic submittals, the table of contents or index shall include electronic bookmarks to the first page of the respective Section(s) identified.

B. Product Data: Collect information into a single Submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for Submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each Submittal to indicate which products and options are applicable.
3. Include the following information, as applicable:
a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Color charts as required by individual Specification Sections.
e. Manufacturer's catalog cuts.

f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.
i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Maintain copy of returned Submittal for Project records.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale where appropriate. Scale shall be sufficiently large to indicate pertinent features of the item and its method of connection to the Work.
1. Preparation: Fully illustrate requirements of the Contract Documents. Include the following information, as applicable:
a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Colors and materials as applicable.
e. Roughing-in and setting diagrams.
f. Wiring diagrams showing field-installed wiring, including power, signal, control, and communication wiring. Differentiate between Manufacturer-installed and field-installed wiring.
g. Manufacturing instructions.
h. Templates and patterns.
i. Schedules.
j. Calculations.
k. Compliance with specified standards.
l. Notation of coordination requirements.
m. Notation of dimensions established by field measurement.
n. Relationship to adjoining construction clearly indicated.
2. Sheet Size: Submit Shop Drawings on sheets at least 8-1/2 inches x 11 inches but no larger than 36 inches x 48 inches.
3. Maintain copy of returned Submittal for Project records.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements, and for a comparison of these characteristics between Submittal and actual component as delivered and installed.
1. Transmit Samples that contain multiple, related components, such as accessories, together in one Submittal package.
2. Identification: On unexposed side of Samples, attach label that includes the following:
a. Generic description of Sample.
b. Product name and name of Manufacturer.
c. Sample source.
d. Number and title of appropriate Specification Section.
3. Samples for Initial Selection: Submit Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available. Where Contract Documents indicate custom color or material, coordinate production of custom Samples with the Engineer and Manufacturer prior to submittal.
a. Number of Samples: Unless indicated otherwise, submit 2 full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from Manufacturer's product line. Engineer will return 1 Sample with options selected.
4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, physically identical with material or product proposed for use, and that show full range of color and texture variations expected.
5. Samples include, but are not limited to, the following: Partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

6. Number of Samples: Unless indicated otherwise, submit 2 sets of Samples. Engineer will retain 1 Sample set; remainder will be returned.
   a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
   b. If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
7. Disposition: Maintain sets of approved Samples at Site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used by Engineer to determine final acceptance of construction associated with each set.
   a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples shall be in an undamaged condition at time of Substantial Completion.
   b. Samples not incorporated into the Work, or otherwise designated to become Owner's property, are the property of Contractor.

E. Operation and Maintenance Manuals:
1. General:
   a. Where manuals are required to be submitted covering items included in the Work, prepare such manuals in durable plastic binders approximately 8-1/2 inches x 11 inches in size and with at least the following:
      1) Identification on, or readable through, the front cover stating general nature of the manual.
      2) Include a table of contents or index with each Submittal, near the front of the manual. As part of electronic submittals, the table of contents or index shall include electronic bookmarks to the first page of the respective Section(s) identified.
      3) Complete instructions regarding operation and maintenance of equipment involved, including:
         a) Equipment function, normal operating characteristics, and limiting conditions.
         b) Assembly, installation, alignment, adjustment, and checking instructions.
         c) Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
         d) Maintenance instructions, including lubrication requirements where applicable.
         e) Guide to "troubleshooting".
         f) Parts lists and predicted life of parts subject to wear.
         g) Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams. Wiring diagrams shall reflect final, as-installed conditions and include wire numbers.
         h) Test data and performance curves.
      4) Complete nomenclature of all replaceable parts, their part numbers, current costs, and name and address of nearest vendor of parts.
      5) Copies of guarantees and warranties issued.
      6) Copies of the reviewed Submittals.
      7) Copies of data concerning changes made during construction.
2. Extraneous Data: Where contents of the manuals include Manufacturer's catalog pages, clearly indicate the precise items included in this installation and delete all Manufacturers' data with which this installation is not concerned. Do not use highlighting that would not be reproducible.
3. Number of Copies Required: Unless otherwise specifically directed by Engineer, or stipulated in the pertinent Section of these Specifications:
   a. For review, submit 1 paper and 1 electronic copy.
   b. For record, deliver 4 paper and 1 electronic copies to Engineer.
4. Schedule delivery of record copies of operation and maintenance manuals at least 60 days prior to startup of respective equipment, unless otherwise specified.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by individual Specification Sections. Do not use highlighting that would not be reproducible. Include a table of contents or index with each Submittal. As part of electronic submittals, the table of contents or index shall include electronic bookmarks to the first page of the respective Section(s) identified.

B. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

E. Installer Certificates: Prepare written statements on Manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by Manufacturer for this Project.

F. Manufacturer Certificates: Prepare written statements on Manufacturer's letterhead certifying that Manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

G. Product Certificates: Prepare written statements on Manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

H. Material Certificates: Prepare written statements on Manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

J. Product Test Reports: Prepare written reports indicating current product produced by Manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by Manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
   1. Name of evaluation organization.
   2. Date of evaluation.
   3. Time period when report is in effect.
   4. Product and manufacturers' names.
   5. Description of product.
   6. Test procedures and results.
   7. Limitations of use.

L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

O. Manufacturer's Instructions: Prepare written or published information that documents Manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of Manufacturer. Include the following, as applicable:
   1. Preparation of substrates.
   2. Required substrate tolerances.
   3. Sequence of installation or erection.
   4. Required installation tolerances.
   5. Required adjustments.
   6. Recommendations for cleaning and protection.

P. Manufacturer's Field Reports: Prepare written information documenting tests and inspections of factory-authorized service representative. Include the following, as applicable:
   1. Name, address, and telephone number of factory-authorized service representative making report.
   2. Statement of substrate condition and acceptability of substrate for installation or application of product.
   3. Statement that products at Site comply with requirements.
   4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
   5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
   6. Statement whether conditions, products, and installation will affect warranty.
   7. Document settings in writing.
   8. Other required items indicated in individual Specification Sections.

2.3 DELEGATED-DESIGN SUBMITTALS

A. Where design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated, which Contractor has coordinated with the balance of the Project.

B. Performance type design documents and calculations shall be prepared by a design professional as required by the individual Specification Section, licensed in the State where the Project is being constructed. Design documents shall be signed and sealed by the responsible design professional. Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Identify name and version of software, if any, used for calculations.

C. In addition to Shop Drawings, Product Data, and other required Submittals, submit two copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each Submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Verify field dimensions and conditions; note corrections as necessary. Mark with approval stamp before submitting to Engineer.
   1. Approval Stamp: Stamp each Submittal with an approval stamp. Use the same stamp format for each Submittal. Include Project name and location, Submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that Submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

B. Submittals that are not approved and stamped by Contractor will be rejected.

3.2 ENGINEER'S REVIEW

A. Action Submittals: Engineer will review Action Submittals, make marks to indicate corrections or modifications required, and return Submittal. Engineer will stamp each Submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
   1. Reviewed, No Exceptions Noted: Submittal appears to conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
   2. Reviewed With Corrections Noted: Upon incorporation of review comments, it appears that Submittal will conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
   3. Revise and Resubmit: Submittal has one or more specific segments that are incomplete, do not appear to conform to the information given in the Contract Documents, or are incompatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Contractor shall resubmit information for review to demonstrate understanding of comments and portions of Work to be provided. Except as noted, Contractor shall not proceed with Work related to Submittal.
   4. Rejected, Resubmit: Submittal as a whole is incomplete, does not appear to conform to the information given in the Contract Documents, or is incompatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Contractor shall resubmit information for review to demonstrate understanding of comments and portions of Work to be provided. Contractor shall not proceed with Work related to Submittal.

B. Informational Submittals: Other Submittals required by the Contract Documents are for information only. Engineer will acknowledge receipt of Informational Submittals. Such Submittals include, but are not limited to:
   1. Qualifications Data.
   2. Certificates.
   3. Test Reports.
   4. Manufacturer's Instructions.
   5. Maintenance Data.
   6. Field Reports.

C. Delegated-Design Submittals: Review of Delegated-Design Submittals by Engineer shall not relieve Contractor of Contractor's sole responsibility for design and achieving specified performance.

D. Submittals not required by the Contract Documents will be returned without being reviewed.

E. Partial Submittals are not acceptable, will be considered non-responsive, and will be rejected.

3.3 RE-REVIEW COSTS

A. Compensation:
   1. Should Engineer be required to review a Submittal more than twice because of failure of the Submittal to meet the requirements of the Contract Documents, Engineer will record Engineer's expenses for performing additional reviews.
   2. Owner will compensate Engineer for these additional services and deduct the amount paid from payments to Contractor.

END OF SECTION 01 33 00

SECTION 01 41 00 – REGULATORY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for requirements and fees of regulatory agencies.

B. Related Sections include permits and licenses indicated in other Sections.

C. The General Conditions requires that Contractor obtain and pay for all construction permits. This Section includes provisions for specific permits but does not include all permits.

1.3 PERMITS

A. Soil Erosion and Sedimentation Control:
   1. Contractor has to obtain a soil erosion and sedimentation control permit from Soil Erosion Local Enforcing Agency.
   2. Pay fees and charges.
   3. Comply with requirements and conditions of the permit.

1.4 OTHER PERMITS

A. Owner has applied for and has obtained the following permits:
   1. Water System Construction (Act 399, P.A. 1976):
      a. Agency: EGLE.
      b. Permit No.: ACT-xx399385.
      c. Issued Date: April 16, 2025.

B. Permit Compliances:
   1. Ensure that permit has been issued prior to beginning the Work.
   2. Comply with requirements of permits.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 41 00

SECTION 01 42 00 – REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for references throughout the Contract Documents.

1.3 DEFINITIONS

A. Abbreviations:
1. AASHTO - American Association of State Highway and Transportation Officials, 444 North Capitol Street, N.W., Suite 249, Washington, DC 20001.
2. ACI - American Concrete Institute, 38800 Country Club Dr., Farmington Hills, MI 48331.
3. AISC - American Institute of Steel Construction, Inc., One East Wacker Dr., Suite 700, Chicago, IL 60601-1802.
4. AITC - American Institute of Timber Construction, 7012 S. Revere Pkwy., Suite 140, Centennial, CO 80112.
5. ANSI - American National Standards Institute, 25 West 43rd St., 4th Floor, New York, NY 10036.
6. APA - American Plywood Association, 7011 S. 19th Street, Tacoma, WA 98466-5333.
7. ASTM - American Society for Testing and Materials, 100 Barr Harbor Dr., West Conshohocken, PA 19428-2959.
8. AWS - American Welding Society, Inc., 550 N.W. LeJeune Road, Miami, FL 33126.
9. AWWA - American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.
10. CPA – Composite Panel Association, 19465 Deerfield Avenue, Suite 306, Leesburg, VA 20176.
11. CRSI - Concrete Reinforcing Steel Institute, 933 Plum Grove Road, Schaumburg, IL 60173-4758.
12. EGLE - Michigan Department of Environment, Great Lakes and Energy, 525 West Allegan Street, P.O. Box 30473, Lansing, MI 48909-7973.
13. MDNR - Michigan Department of Natural Resources, 530 West Allegan Street, P.O. Box 30028, Lansing, MI 48909.
14. MDOT - Michigan Department of Transportation, 425 West Ottawa Street, P.O. Box 30050, Lansing, MI 48909.
15. MDCH - Michigan Department of Community Health, 201 Townsend Street, Lansing, MI 48913.
16. MIOSHA - Michigan Department of Licensing and Regulatory Affairs, Michigan Occupational and Health Administration, State Secondary Complex, 7150 Harris Drive, P.O. Box 30643, Lansing, MI 48909-8143.
17. NCMA - National Concrete Masonry Association, 13750 Sunrise Valley Drive, Herndon, VA 20171-4662.
18. NEC - National Electrical Code (see NFPA 70).
19. NEMA - National Electrical Manufacturers' Association, 1300 N. 17th Street N.W., Suite 1752, Rosslyn, VA 22209.
20. NFPA - National Fire Protection Association, One Batterymarch Park, Quincy, MA 02169-7471.
21. PCI - Precast Concrete Institute, 200 West Adams, Suite 2100, Chicago, IL 60606.
22. SDI - Steel Deck Institute, P.O. Box 25, Fox River Grove, IL 60021.
23. SJI - Steel Joist Institute, 234 West Cheves Street, Florence, SC 29501.
24. UL - Underwriters' Laboratories, Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

1.4 REFERENCES

A. The provisions of the Contract Documents shall govern over any conflicting provisions of the referenced documents.

B. The provisions of laws and regulations shall govern over any conflicting provisions of the referenced documents.

C. Comply with the referenced document that is in effect as of the Bid date, except when a specific date is specified.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 42 00

SECTION 01 45 34 – SPECIAL INSPECTIONS AND TESTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for special inspections as follows and includes the Statement of Special Inspections.
   1. Special inspections of structures.
   2. Special inspections within structures.
   3. Special inspections of underground components within 5 feet outside of the footprints of structures.

B. Special inspection services which will be paid from a cash allowance as specified in Division 01 Section “Cash Allowances” and performed by a special inspector or inspectors selected by Owner:
   1. Concrete construction.
   2. Masonry construction.
   3. Soils.
   4. Travel expense of the special inspector.

C. Include the following testing, special inspections and certifications in the Contractor’s Base Bid:
   1. Inspections and tests required by codes or ordinances or by an authority having jurisdiction and made by a legally constituted authority.
   2. Inspections, testing services and certifications including, but not limited to, the following:
      a. Structural steel yield strength mill tests.
      b. Manufacturers' certification tests for cement.
      c. Supplier’s certification tests for fine and coarse aggregate.
      d. Aggregate alkali reactivity testing.

D. Owner Paid Items: Owner may elect to inspect or to employ either Engineer or a special inspector to inspect materials or systems on the Project other than those specified herein. The cost of this inspection will be paid for by Owner.

E. Special inspection services are required to verify compliance with the Contract Documents and with the requirements of the Building Code. These services do not relieve Contractor of responsibility for verification of compliance with Contract Document requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AASHTO:
      a. T259 - Method of Test for Resistance of Concrete to Chloride Ion Penetration.
      b. TP 23 - Standard Test Method for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
   2. ACI - American Concrete Institute:
      a. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
      b. 301 - Specification for Structural Concrete.
      c. 318 - Building Code Requirements for Reinforced Concrete.
   3. ASTM Standards:
      a. C31 - Practice for Making and Curing Concrete Test Specimens in the Field.
      b. C33 - Specification for Concrete Aggregates Including Appendix XI.
      c. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      d. C42 - Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

e. C138 - Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete.
f. C140 - Test Methods of Sampling and Testing Concrete Masonry Units and Related Units.
g. C143 - Test Method for Slump of Hydraulic-Cement Concrete.
h. C157 - Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
i. C172 - Practice for Sampling Freshly Mixed Concrete.
j. C173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
k. C192 - Practice for Making and Curing Concrete Test Specimens in the Laboratory.
l. C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
m. C295 - Guide for Petrographic Examination of Aggregates for Concrete.
n. C1019 - Test Method for Sampling and Testing Grout.
o. C1077 - Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
p. D698 - Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort.
q. D1556 - Test Method for Density and Unit Weight of Soil In Place by Sand-Cone Method.
r. D1557 - Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
s. D1586 - Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.
t. D2166 - Test Method for Unconfined Compressive Strength of Cohesive Soil.
u. D2167 - Test Method for Density and Unit Weight of Soil In Place by the Rubber Balloon Method.
v. D2937 - Test Method for Density of Soil in Place by Drive-Cylinder Method.
w. D3740 - Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.
x. D6938 - Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

4. Michigan 2021 Building Code.
5. MDOT:
   a. Standard Specifications for Construction.
   b. Density Testing and Inspection Manual.

1.4 DEFINITIONS

A. Terms:
1. Building Code: The building code plus amendments, if any, legally adopted for the location in which the Project is located.
2. Special Inspection: Inspection and testing as herein required of materials, installation, fabrication, erection or placement of components and connections requiring special expertise of one or more approved special inspectors in order to ensure compliance with the Building Code and the Contract Documents.
3. Testing Agency; Independent Testing Agency: Special inspector.

1.5 PERFORMANCE REQUIREMENTS

A. Special Inspector Qualifications:
1. Qualified in accordance with the Building Code and by local building official.
2. Objective, competent and independent from the contractor performing the work to be inspected.
3. Familiar with Building Code requirements for special inspections.
4. Having adequate equipment, periodically calibrated as required, to perform the special inspections.
5. Employing experienced personnel educated in conducting, supervising and evaluating special inspections similar in complexity to that required for the Project.
6. Submission of Qualifications:
   a. Special Inspector: Provide to the building official written documentation as required to demonstrate competence, objectivity and experience or training.
   b. Disclose possible conflicts of interest.

B. Perform special inspections in accordance with:
1. Laws and Regulations.
2. Reference procedures and requirements.
3. Building Code.
4. Contract Documents.
5. Manufacturer’s requirements, as applicable.
6. Reviewed submittals for the Project, as applicable.

1.6 REINSPECTION COSTS

A. Reinspection:
   1. When initial special inspections of items except soil compaction indicate noncompliance with the Contract Documents, subsequent special inspections occasioned by the noncompliance shall be performed by the same special inspection agency, and the costs thereof will be deducted by the Owner from the Contract Sum.
   2. Soil Compaction:
      a. The first retesting of soil compaction shall be paid for in accordance with the provisions of the Contract Documents.
      b. The second and subsequent retesting for soil compaction due to noncompliance with the Contract Documents shall be performed by the same special inspection agency, and the costs thereof will be deducted by the Owner from the Contract Sum.

B. Uncovering Costs: Paid for as described in the General Conditions.

1.7 REPORTS AND SUBMISSIONS

A. Special Inspection Reports:
   1. Special Inspector: Keep records of special inspections in accordance with the Building Code.
   2. Records: Indicate that work inspected was or was not completed in conformance with the Contract Documents.
   3. Report and reinspect non-conformances until they are in conformance with the Contract Documents.
   4. Final Report:
      a. Prepare and submit a final report at the completion of the special inspections.
      b. Document the completion of specified special inspections and correction of discrepancies.
      c. Submit as specified for inspection reports.
   5. Provide typed electronic copies of reports to:
      a. Owner.
      b. Engineer.
      c. Contractor.
      d. Building official.
   6. Discrepancies: Bring to immediate attention of Contractor, and, if not corrected, to attention of Engineer and building official.

1.8 SCHEDULES FOR SPECIAL INSPECTIONS

A. Establishing Schedule: By advance discussion between special inspector and Contractor, determine the time required to perform special inspection and to issue findings.

B. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate such changes of schedule with the special inspector.

C. Adherence to Schedule: When the special inspector is ready according to the determined schedule, but is prevented from performing special inspection due to incompleteness of the Work, extra costs attributable to the delay may be charged to Contractor and shall not be borne by Owner.

1.9 CONTRACTOR'S DUTIES

A. Cooperate with Special Inspector:
   1. Schedule the Work so that special inspector is allowed a reasonable schedule and amount of time to access and view the components requiring special inspection before being obscured by subsequent construction.
   2. Notify special inspector 24 hours minimum prior to expected time when special inspection services will be required.

3. Provide the following as necessary for special inspector to properly perform its functions:
   a. Access to the Work.
   b. Facilities for access to the Work.
   c. Tools.
   d. Storage.
   e. Assistance as requested.

B. Submission of Written Statements:
   1. To be submitted by each contractor responsible for construction of a main wind or seismic force resisting system, designated seismic system or a wind or seismic resisting component listed in the Statement of Special Inspections.
      a. Submit to building official, Owner, and Engineer, prior to commencement of construction on the respective system or component.
      b. Acknowledging awareness of the special inspections specified herein.
   2. Each fabricator, at the completion of their respective fabrication, shall submit a certificate of compliance to the building official and Engineer stating that the fabrication was performed in accordance with the Contract Documents.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 STATEMENT OF SPECIAL INSPECTIONS

A. Frequency of Special Inspections:
   1. The minimum frequency of the special inspections (periodic vs. continuous) shall be as indicated in the Building Code.
   2. Quality assurance inspections performed in accordance with standards referenced herein shall conform to the frequency requirements indicated in those standards.

B. Concrete Construction:
   1. Special Inspections:
      a. Except for material testing, perform special inspections in accordance with Table 1705.3 of the Building Code and this Specification for all concrete.
      b. Inspect and verify:
         1) Reinforcing steel and placement.
         2) Anchor rods prior to and during placing of concrete.
         3) Anchors post-installed in hardened concrete.
         4) Proper use of required design mix.
         5) Proper placement of concrete.
         6) Maintenance of specified curing techniques and temperatures.
         7) Concrete formwork for proper shape, location and dimension.
   2. Concrete Material Testing:
      a. Perform material testing in accordance with Table 1705.3 of the Building Code and this Specification for all concrete.
      b. Point of sampling and the method of securing the Samples:
         1) Determined by special inspector.
         2) In accordance with ASTM C172.
      c. Slump Tests:
         1) Perform slump tests in accordance with ASTM C143.
         2) Perform one slump test on the Site for each 10 cubic yards of concrete.
         3) At Engineer's request, also perform slump tests at batch plant before adding water reducer.
         4) Perform more slump tests if deemed necessary by Engineer.
      d. Perform 1 air-entraining test in accordance with ASTM C231 or C173 for each truckload or every 10 yards of concrete placed, whichever is more frequent.
      e. Test the concrete unit weight in accordance with ASTM C138 or C567, as applicable.
      f. Test the air content and fresh concrete temperature of each set of concrete cylinders.

g. Concrete Cylinder Testing:
   1) In accordance with ASTM C31 and C39.
   2) Take concrete cylinder Samples as follows:
      a) Once each day a given class of concrete is placed, nor less than
      b) Once for each 150 cubic yards (or fraction thereof) of each class of concrete placed each day, nor less than
      c) Once for each 5,000 square feet of slab or wall surface area placed each day.
   3) Concrete cylinder Sample shall consist of a minimum of 4 cylinders.
      a) Make standard 6x12 cylinders, except that for concrete mixes with 1-inch or smaller coarse aggregate, 4x8 cylinders may be used.
      b) Contractor shall be responsible for having additional pairs of cylinders taken and tested, if required to demonstrate adequate concrete strengths at ages earlier than 28 days if Contractor's schedule requires form removal from load-bearing concrete prior to 28 days.
   4) Handle cylinders carefully.
   5) On Site Storage:
      a) 12 hours, minimum, 48 hours maximum.
      b) At a temperature range of 60 to 80 degrees F and in a moist environment.
      c) Shielded from direct sunlight and radiant heat.
      d) The Contractor shall construct heated or water bath enclosures, as applicable, if conditions require.
      e) Cylinders Samples taken to establish adequate strength for form removal earlier than 28-days shall be cured in locations that represent the conditions under which the structural concrete will be cured.
   6) Laboratory Curing:
      a) For duration of curing after on Site storage.
      b) Does not include cylinders taken to establish adequate strength for form removal earlier than 28-days.
   7) Test 1 of the cylinders at 7 days and 2 cylinders at 28 days. Save 1 cylinder as a spare.
   8) Acceptance and evaluation of the concrete shall be based on ACI 301.

C. Masonry Construction:
   1. Inspect and verify masonry in accordance with the quality assurance requirements of TMS 402/ACI 530/ASCE 5, TMS 602/ACI 530.1/ASCE 6 and the Contract Documents.
      a. In addition, also inspect and verify:
         1) Anchor rods prior to and during placing of masonry.
         2) Anchors post-installed in hardened masonry.
      b. Verification of masonry compressive strength f'_m shall follow the provisions for the unit strength method.
      c. Comply with Level B special inspection.

D. Soils:
   1. Inspect and verify in accordance with Table 1705.6 of the Building Code and this Specification.
   2. Inspect and verify:
      a. Soil Below Shallow Foundations:
         1) Verify materials and compaction are suitable to support the structures at the design soil bearing value indicated on the Drawings with acceptable anticipated settlement.
      b. Excavations are extended to proper depth and reached proper material.
      c. Classification of structure fill and backfill material.
      d. Classification of utility backfill material.
      e. Use of proper fill and backfill materials, lift thicknesses and compaction.
      f. Prior to placement of fill, subgrade material and preparation, and subgrade compaction.

      g. Minimum Frequency of Soil Compaction Verification:
         1) Within Footprint of Structures:
            a) One test per 1,000 square feet of subgrade for each layer of fill.
      h. Perform more frequent testing when necessary because of Site conditions and approved by Owner.

END OF SECTION 01 45 34

SECTION 01 45 35 – TESTING SERVICES FOR BURIED UTILITIES, ROADWAYS, AND SITE PROJECTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes testing services as follows:
   1. Testing services which will be paid for from a cash allowance as specified in Division 01 Section "Cash Allowances" and performed by an independent testing agency selected by the Engineer:
      a. Fill material from onsite and offsite.
      b. Fine and coarse aggregate certification tests.
      c. Bedding material certification tests.
      d. Bituminous pavement materials.
      e. Laboratory soil proctor tests.
      f. Soil compaction tests.
      g. Verification of soil bearing capacity.
      h. Base and subbase compaction tests.
      i. Pavement compaction tests.
      j. Collecting and transporting soil samples to the independent testing agency's laboratory.
      k. Laboratory soil proctor tests.
      l. Concrete slump and air entrainment tests.
      m. Concrete cylinder compressive strength tests.
      n. Travel expense of the independent testing agency.
      o. Making concrete cylinders.
      p. Transporting cylinders to testing agency's laboratory and performing tests.
   2. Testing services and certifications which are not included under the cash allowance, should be included in the Contractor's base Bid:
      a. Pipe leakage and pressure tests.
      b. Pipe material tests.
      c. Testing performed for the Contractor's convenience.
   3. Owner Paid Items:
      a. The Owner may elect to inspect or test or to employ either the Engineer or an independent testing agency to test materials on the Project other than those specified herein.
      b. The cost of this testing will be paid for by the Owner.

B. Testing services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for verification of compliance with Contract Document requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AASHTO: Provisional Standard - TP 23 Standard Test Method for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
   2. ASTM Specifications, Tests and Test Methods:
      a. C31 - Making and Curing Concrete Test Specimens in the Field.
      b. C33 - Specification for Concrete Aggregates Including Appendix XI.
      c. C39 - Test for Compressive Strength of Cylindrical Concrete Specimens.
      d. C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
      e. C138 - Test for Unit Weight, Yield and Air Content of Concrete.
      f. C143 - Test for Slump of Portland Cement Concrete.
      g. C172 - Sampling Fresh Concrete.
      h. C173 - Test for Air Content of Freshly Mixed Concrete by the Volumetric Method.
      i. C192 - Making and Curing Concrete Test Specimens in the Laboratory.
      j. C227 - Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).

k. C231 - Test for Air Content of Freshly Mixed Concrete by the Pressure Method.
l. C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).
m. C295 - Standard Guide for Petrographic Examination of Aggregates for Concrete.
n. C567 - Unit Weight of Structural Lightweight Concrete.
o. C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
p. D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort.
q. D1188 - Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
r. D1556 - Density of Soil In Place by the Sand-Cone Method.
s. D1557 - Moisture-Density Relations of Soils and Soils Aggregate Mixture Using 10 Pound Rammer and 18-Inch Drop.
t. D1586 - Penetration Test and Split Barrel Sampling of Soils.
u. D1883 - CBR (California Bearing Ratio) of Laboratory Compacted Soils.
v. D2166 - Unconfined Compressive Strength of Cohesive Soil.
w. D2167 - Density of Unit Weight of Soil In Place by the Rubber Balloon Method.
x. D2922 - Density of Soil and Soil Aggregates by Nuclear Methods.
y. D2937 - Density of Soil in Place by Drive Cylinder Method.
z. D2950 - Test Methods for Density of Bituminous Concrete in Place by Nuclear Methods.
aa. D3666 - Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.
bb. D3740 - Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as used in Engineering Design and Construction.

3. ACI - American Concrete Institute:
   a. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
   b. 211.1R - Report on Alkali-Aggregate Reactivity.
   c. 301 - Specification for Structural Concrete for Buildings.
   d. 318 - Building Code Requirements for Reinforced Concrete.
4. MDOT Standards: Michigan Cone Test for Determination of Maximum Unit Weight of Granular Soils.

1.4 TEST REQUIREMENTS

A. In accordance with:
   1. Laws and Regulations.
   2. Sections of these Specifications.
   3. Reference procedures and requirements.
   4. Pertinent standards for testing.

B. Testing Agency Qualifications:
   1. Approved by authorities having jurisdiction.
   2. Agency whose primary business is materials and construction testing.
   3. Approved by the Engineer or the Owner.
   4. Objective, competent and independent from the Contractor performing the work to be inspected.
   5. Having adequate equipment, periodically calibrated as required, to perform the special inspections.
   6. Employing experienced personnel educated in conducting, supervising and evaluating special inspections similar in complexity to that required for the Project.

1.5 RETESTING COSTS

A. Retesting:
   1. When initial special inspections of items except soil compaction indicate noncompliance with the Contract Documents, subsequent special inspections occasioned by the noncompliance shall be performed by the same special inspection agency, and the costs thereof will not be reimbursed.
   2. Soil Compaction:
      a. The first retesting of soil compaction shall be paid for in accordance with the provisions of the Contract Documents.
      b. The second and subsequent retesting for soil compaction due to noncompliance with the Contract Documents shall be performed by the same special inspection agency, and the costs thereof will not be reimbursed.

1.6 REPORTS

A. Provide the Engineer's field representative and Contractor's superintendent with a draft copy of the daily report prior to leaving the Project Site each day on which testing is performed on the Site.

B. Provide typed copies of testing agency reports, inspections, and certifications within 5 business days to:
   1. The Engineer's Office: One copy.
   2. The Contractor's Office: One copy.

1.7 SCHEDULING TESTING

A. Coordinate and schedule the work of the independent testing agency.
   1. Notify the Engineer and the independent testing agency 48 hours prior to the expected time when testing services will be required.
   2. Provide access to the Work as necessary for the agency to properly perform its functions.

B. Establishing Schedule: By advance discussion with the Engineer and independent testing agency, determine the time required to perform tests and to issue findings.

C. Revising Schedule: When changes of construction schedule are necessary during construction, coordinate all such changes with the independent testing agency as required.

D. Adherence to Schedule: When the independent testing agency is ready to test according to the determined schedule, but is prevented from testing or taking specimens due to incompleteness of the Work, all extra costs for testing attributable to the delay will be paid by the Contractor.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 TESTING REQUIREMENTS

A. Fine and Coarse Aggregate and Bedding Material:
   1. Sieve test to ensure compliance with the materials specifications.
   2. Provide 1 test for each source of imported materials as directed by the Engineer.

B. Fill Material from Onsite and Offsite Sources: Sieve test to ensure compliance with the materials specifications.

C. Soil Compaction:
   1. Minimum Frequency of Testing:
      a. Within the Building Footprint: See Division 01 Section "Special Inspections and Tests."
      b. Outside a Building Footprint: One test per 5,000 square feet of subgrade for each layer of fill.
      c. Utility Trenches: One test for every 200 linear feet of trench length at each lift.
      d. Utility Structures: One test under each manhole, vault or other structure.
      e. Curb and Gutter: One test for every 100 linear feet.
      f. Pavement Subgrade, Base Grade:
         1) One test for every 2,500 square feet for road construction.
         2) One test at every driveway or curb cut location.
         3) One test for every 500 square feet for road intersections.
   2. Predominately Granular Soils:
      a. Perform necessary laboratory and field testing required to verify compaction of fill, bedding, trench backfill and structure backfill in accordance with ASTM D1557 or Michigan Cone.
      b. Verify the compaction of the first 12 inches of the existing subgrade below structures, utility structures, paved areas, and areas to be filled in accordance with ASTM D1557 or Michigan Cone.

3. Predominately Cohesive Soils:
   a. Perform necessary laboratory and field testing required to verify compaction of fill trench backfill and structure backfill in accordance with ASTM D698.
   b. Verify the compaction of the first 12 inches of the existing subgrade below structures, utility structures, paved areas, and areas to be filled in accordance with ASTM D698.
4. Independent testing agency shall inform the Engineer and the Contractor's onsite supervisor immediately of onsite test results.
5. Place no additional fill in areas where compaction results do not meet Specification requirements.

D. Testing Bituminous Paving:
1. The testing agency shall provide quality control and testing services that will be monitored by the Engineer's field representatives continuously during paving.
2. The testing agency shall take 1 mixture sample per day and 1 test per 1,000 tons of material placed.
   a. This sample shall be taken randomly from the back of the hauling unit.
   b. This sample shall be large enough to provide the Contractor, testing agency, and Engineer with an equal split of the sample.
   c. The testing agency shall test the samples for the following:
      1) 50 blow Marshall bulk specific gravity or a 50 gyration gyratory compactor bulk specific gravity (G_{mb}).
      2) Theoretical Maximum Density (TMD) (AASHTO T209) or maximum specific gravity of paving mixture (no air voids) (G_{mm}).
      3) % Asphalt binder.
      4) Aggregate gradation and % crushed aggregate.
   d. With the above information and the mix design aggregate effective specific gravity, calculate the following:
      1) Mixture air voids.
      2) Mixture voids in the mineral aggregate (VMA) using bulk specific gravity of aggregate (Gsb).
      3) % Asphalt binder.
3. The results of these tests shall be compared to the approved mix design and must be within the tolerances indicated below or all additional truck loads of non-compliant material shall be removed from the Site.
   a. The material supplier shall then make recommendations to the Engineer of how the mixture will be revised to meet the Specifications.
   b. The results of these tests and the split samples must be presented to the Engineer before mixture production begins the following day.
   c. If the Engineer wishes to test the split samples, they may use the supplier's laboratory and equipment.
   d. The Engineer reserves the right to work with the supplier and modify the supplier's mix design to ensure the product meets the Drawings and Specification requirements.
   e. This may include increasing asphalt content and adjusting aggregate gradations within the bituminous mixture composition specification.

Testing/Verification Tolerances

Parameter	Single test	Average of 2 or more tests	Comments
Air Voids	±1.00%	-1.0%+0.5%	
VMA	±1.20%	±1.20%	
TMD (G_{mm})	±0.019	±0.015	
Asphalt Binder	±0.4%	±0.3%	>0.4% less than JMF may be subject to reduced payment
%Fines/% Asphalt	Max 1.6	Max 1.6	Result must be less than 1.6
#4 sieve	±5.0%	±3.0%	
#30 sieve	±4.0%	±3.0%	
#200 sieve	2.0%	±1.0%	
Crushed Particles	±10%	±10%	>10% less than JMF may be subject to reduced payment

4. The Contractor shall have the testing agency's density technician and a density gage available whenever paving is occurring. This technician and gage shall monitor placement and compaction of asphalt to verify the maximum density possible is being achieved.
5. The testing agency shall take 1 core on each 25,000 square feet of new parking lot.
    a. The percent compaction of these cores shall be calculated using the TMD of the approved mix design (JMF) unless otherwise directed and the results used for determining compliance with this Specification.
    b. The daily average in place density:
        1) Low/medium Volume Roads: 95.0% of the mixture's TMD or greater with a minimum density of 94% of TMD.
        2) Heavy Volume Roads: 94% of the mixtures TMD or greater with a minimum density of 93% TMD.
    c. Areas that are not compacted to the specified daily average will be evaluated by the Engineer and may either be removed or subject to a price reduction.
6. Thickness: In place compacted thickness tested in accordance with ASTM D3549.
7. Surface Smoothness:
    a. Test finished surface of each hot mix asphalt course for smoothness, using 10 foot straightedge applied parallel with and at right angles to centerline of paved area, or by measuring depths of bird baths immediately after a rain.
8. Workmanship:
    a. Finished Surfaces, Especially in High Visibility Areas: Smooth, free of cracks, raveling or spalling holes, rake or roller marks and depressions, or bird baths.
    b. Problem Areas Identified: Correct by removing, paving or reheating and re-rolling if possible.
9. Test Reports:
    a. Summarize the results of the bituminous paving using the "Report of Verification/Acceptance Testing & Core Density."
    b. Electronically submit this document to the Project team on a daily basis prior to the placement of any subsequent pavement.
10. Porous Bituminous Asphalt:
    a. Mix Verification (ASTM D2172): One test per 1,000 ton placed or fraction thereof.
    b. Weight Slips:
        1) Furnish weight slips for material incorporated in the Project.
        2) Verify that the required tonnage has been applied by calculating and submitting yield for each day of work.
    c. Compaction and Thickness Testing:
        1) Nuclear Gage (ASTM D2950): Minimum 5 per day or 1 test per 7,500 square feet.
        2) Pavement Cores: Minimum 2 per day or 1 test per 20,000 square feet or as directed.
    d. Field Infiltration Test:
        1) In accordance with ASTM C1701.
        2) One test per 25,000 square feet.
        3) Witnessed by Engineer.
    e. Surface Smoothness: Test using a 10 foot straightedge applied parallel to and at right angles with the centerline.

E. Concrete Testing:
1. Point of sampling and the method of securing the Samples:
    a. Determined by the independent testing agency.
    b. In accordance with ASTM C172.
2. Slump Tests:
    a. Perform slump tests in accordance with ASTM C143.
    b. Perform 1 slump test on the Site for each truckload of concrete.
    c. At the Engineer's request, also perform slump tests at batch plant before adding water reducer.
    d. Perform more slump tests if deemed necessary by the Engineer.
3. Perform 1 air-entraining test in accordance with ASTM C231 or C173 for each truckload of concrete.
4. Test the concrete unit weight in accordance with ASTM C138 or C567, as applicable.
5. Test the air content and fresh concrete temperature of each set of concrete cylinders.
6. Concrete Cylinder Testing:
    a. In accordance with ASTM C31 and C39.
    b. Take concrete cylinder Sample set as follows:
        1) Once for each 150 cubic yards (or fraction thereof) of each class of concrete placed each day, nor less than.
        2) Once for each 2,500 square feet of sidewalk or paving surface area placed each day.

c. Concrete Cylinder Sample Set: Consist of 4 standard 6-inch cylinders.
d. Handle cylinders carefully.
e. Onsite Storage:
    1) Handle cylinders carefully.
    2) 12 hours, minimum, 48 hours maximum.
    3) Store at a temperature range of 60 to 80 degrees F and in a moist environment.
    4) Shield from direct sunlight and radiant heat.
    5) Construct heated or water bath enclosures, as applicable, if conditions require.
    6) Cylinder samples taken to establish adequate strength for form removal earlier than 28 days shall be cured in locations that represent the conditions under which the structural concrete will be cured.
f. Laboratory Curing: For duration of curing after onsite storage.
g. Test 1 of the cylinders at 7 days and 2 cylinders at 28 days. Save 1 cylinder as a spare.
h. Acceptance and evaluation of the concrete shall be based on ACI 301.

7. Porous Concrete:
    a. Testing Frequency: Each 150 yd^3 or fraction thereof; minimum 1 set of tests for each day placement.
    b. Field Testing:
        1) Sampling: Plastic concrete in accordance with ASTM C172.
        2) Density:
            a) ASTM C1688/C1688M.
            b) Acceptance - within 5 lb/ft^3 of approved design density (unit weight).
        3) Void Content:
            a) Plastic concrete in accordance with ASTM C1688/C1688M.
            b) Acceptance: Not more than 2% below the specified minimum.
    c. Concrete Cores:
        1) Construct a test panel for each day of production.
            a) Use same materials and procedures as production paving.
            b) Minimum size 5 foot x 5 foot.
        2) Up to 3 cores for each day's production or each 150 yd^3 or fraction thereof or as directed.
        3) In accordance with ASTM C42.
        4) After minimum of 7 days analyze 1 core from the set.
            a) Thickness:
                (1) ASTM C174.
                (2) Acceptance: Untrimmed samples not less than 1/2 inch specified thickness.
            b) Void Content:
                (1) ASTM C642.
                (2) A New Test Method for Porosity Measurements of Portland Cement Pervious Concrete *Felipe Montes,*1 *Srinivas Valavala,*1 *and Liv M. Haselbach*2; *Journal of ASTM International*, January 2005, Vol. 2, No. 1.
                (3) Acceptance: within specified range.
        5) Density: ASTM C642.

END OF SECTION 01 45 35

SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of construction facilities as follows:
   1. Temporary Utilities: Water, electricity, and telephone.
   2. Contractor's field offices.
   3. Sanitary facilities.
   4. Temporary heat.
   5. Project signs.
   6. Enclosures such as tarpaulins, barricades, and canopies.
   7. Storage areas.

1.3 SUBMITTALS

A. Samples: For construction project identification sign.
   1. Required Sample:
      a. 11 x 17 color proofs of sign representing actual appearance of sign producer’s final product.
      b. Created by sign producer.
   2. Submit and obtain review by Engineer prior to printing final version of vinyl.

1.4 QUALITY ASSURANCE

A. Construction Project Identification Sign Producer Qualifications:
   1. Having a minimum of 3 years experience in production of signs of specified type.

1.5 STORAGE AREAS

A. Locations:
   1. Specific storage locations within the general areas:
      a. Carefully coordinate with Owner.
      b. Subject to approval of Owner.

B. Protection and Restoration:
   1. Protect trees and shrubs in the storage areas.
   2. Replace grass and other vegetation disturbed or damaged in the storage areas.
   3. Take reasonable means to prevent spillage of fuel, oil, chemicals and similar materials.
   4. Clean up spills and, if necessary, remove soil and replace with uncontaminated soil so as to allow vegetation to be quickly reestablished.
   5. Provide secondary containment for storage of hazardous materials, as required by governing authorities or agencies.

C. Cleaning: Keep storage areas clean in accordance with Division 01 Section “Cleaning and Waste Management.”

D. Storage: Maintain in accordance with Division 01 Section “Product Storage and Handling Requirements.”

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. New or used.
2. Adequate in capacity for the required usage.
3. Provide safe conditions.
4. Comply with requirements of applicable codes and standards.

2.2 UTILITIES

A. Temporary Utilities:
1. Equipment Testing:
a. Owner will pay utility charges for all power, water and other utilities.
b. Furnish, install, remove, and pay for associated temporary equipment, piping, pumps, fuel, power distribution, and connections.
2. Water:
a. Owner will pay for water usage charges.
b. Furnish, install, remove, and pay for all temporary piping, water meters, equipment, and connections.
c. Obtain water by connection to Owner's existing water system.
3. Electricity:
a. Owner will pay for electrical usage charges.
b. Furnish, install, remove, and pay for all temporary wiring, equipment switches, panels, connections, and transformers.
c. Furnish, install, remove, and pay for area distribution boxes so located that power and artificial lighting are located at all points where required by the Work.
d. Obtain electrical power by connecting to Owner's existing system.
4. Construction Telephones:
a. Arrange for installation and removal of and pay for temporary telephones.
b. Pay for local telephone usage charges and Contractor's long distance usage charges.
c. Maintain construction telephones in:
1) Contractor's field office.
5. Temporary Sewer:
a. Furnish and install all necessary sumps, pumps and piping.
b. After completion of the Work, remove all such temporary items.

2.3 FIELD OFFICES

A. Contractor's Field Office:
1. Contractor's field office shall have at least 1 outside door.
2. Pay for all heat, electricity, and telephone charges.

2.4 SANITARY FACILITIES

A. Furnish and install required sanitary facilities, including temporary toilet buildings with sanitary toilets and hand washing facilities or hand sanitizing stations, for use of workers; comply with minimum requirements of the Health Department or other public agency having jurisdiction; maintain in a sanitary condition at all times.

2.5 CONSTRUCTION HEATING

A. General:
1. All heating required during the progress of the Work, prior to the installation of the permanent heating system, shall be classified "temporary heat".
2. Prior to the installation of permanent heating equipment, furnish approved heaters and fuel as required.
3. Keep equipment and surroundings in clean, safe condition.
4. Pay all fuel bills for heat.

B. Permanent Heating Equipment:
   1. Notify Engineer when installed and proposed to be used to heat building interior.
   2. Prior to using, provide adequate means to keep internal duct and acoustic liner surfaces clean and in a like-new condition.
   3. Filters:
      a. In accordance with Division 23 Section “HVAC Air Cleaning Devices.”
      b. Securely supported at each return and exhaust air open duct end and grille.
      c. Support filter length at required intervals to prevent filter deformation.
      d. Replaced at intervals required to keep internal duct and acoustic liner surfaces free of construction debris and dust.
   4. Ductwork used by Contractor without adequate protection shall be cleaned to Engineer’s satisfaction.

C. Temperatures:
   1. Except as otherwise called for, a minimum temperature of 50 degrees F and a maximum temperature of 75 degrees F in the building shall be maintained during working hours and above freezing at all other times.
   2. See requirements of various other Sections of these Specifications for minimum temperature to be maintained for the application of work under the various trades.

D. Millwork: Supply adequate heating and ventilation to dry out buildings before installation of finished millwork and trim is started.

2.6 PROJECT IDENTIFICATION SIGN

A. Sign Production:
   1. By vinyl transfer material process.
   2. Vinyl Material:
      a. Heavy duty front lit vinyl.
      b. Cool Flex E-Stat I, by 3M; or equal.
   3. Drymount vinyl to 4-foot x 8-foot x 3/4-inch exterior grade plywood with medium density overlay on front and back faces.
   4. Quantity: 1.

B. Sign Graphic Content:
   1. Provided to Contractor by Engineer at no cost.
   2. Consisting of:
      a. Computer file on disc.
      b. Small scale color copy of intended appearance.

C. Design:
   1. Sign Surface: Exterior softwood 3/4-inch plywood with medium density overlay.

D. Framing Structure:
   1. New or used.
   2. Wood or metal.
   3. In sound condition structurally adequate to support specified sign.
   4. Suitable for specified finish.
   5. Rough Hardware: Galvanized.
   6. Paint: Exterior quality as specified in Division 09 Section “Painting.”

E. Erect in a location:
   1. Onsite and highly visible.
   2. Adjacent to the main entrance.
   3. As approved by Engineer.

2.7 OTHER TEMPORARY CONSTRUCTION FACILITIES

A. Furnish, install, and maintain all other temporary construction facilities necessary for proper completion of the Work.

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with applicable requirements specified in:
   1. Division 22 – Plumbing
   2. Division 23 – Heating, Ventilating, and Air Conditioning.
   3. Division 26 – Electrical.
   4. Local Building Code.

B. Maintain and operate systems to ensure continuous service.

C. Modify and extend systems as Work progress requires.

3.2 REMOVAL

A. Maintain all temporary facilities and controls as long as needed for the safe and proper completion of the Work. Remove all such temporary facilities and controls as rapidly as progress of the Work will permit.

END OF SECTION 01 50 00

SECTION 01 66 00 – PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for the storage and protection of Products.

1.3 STORAGE AND PROTECTION

A. Storage:
   1. Maintain ample way for foot traffic at all times, except as otherwise approved by Engineer.
   2. Repair or replace property damaged by reason of storing of material at no additional cost to Owner.
   3. Packaged Materials:
      a. Delivered in original, unopened containers.
      b. Stored until ready for use.
   4. Materials shall meet the requirements of these Specifications at the time that they are used in the Work.
   5. Store Products in accordance with Manufacturer's instructions.

B. Protection:
   1. Use all means necessary to protect the:
      a. Products of every Section before, during and after installation.
      b. Installed work and materials of all trades.
   2. All materials shall be delivered, stored, and handled to prevent:
      a. The inclusion of foreign materials.
      b. Damage by water, breakage, or other causes.
   3. Provide weathertight storage sheds with raised floors as may be required to adequately protect those materials and Products stored on the Site which may require protection from damage by the elements.

C. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of Engineer and at no additional cost to Owner.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 66 00

SECTION 01 71 23 – FIELD ENGINEERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for the layout of the Work.

1.3 QUALITY ASSURANCE

A. Qualifications: Layout of facility corners and Sitework shall be by a Registered Land Surveyor.

1.4 LAYOUT OF THE WORK

A. Reference Points:
   1. Locate and protect reference points prior to beginning work.
   2. Pay for replacement of reference points if disturbed by Contractor's operations.

B. Lay out all components, including but not limited to:
   1. Walls.
   2. Column centerlines.
   3. Utilities.
   4. Paved areas and roads.
   5. Floors and slabs.
   6. Foundations.
   7. Equipment.
   8. Grades and elevations.

C. Adjustments for Equipment:
   1. Adjust dimensions for the specific equipment to be installed.
   2. Coordinate the adjustments with all trades.
   3. Report the adjustments to Engineer prior to starting the work.

D. Subcontractor Responsibilities:
   1. Require Subcontractor to:
      a. Field verify all dimensions relating to Subcontractor's work prior to starting work.
      b. Field verify that the components to which Subcontractor's work will be applied are in acceptable condition to receive Subcontractor's work.
   2. Report all errors or inconsistencies to Engineer.
   3. Subcontractor: Starting of work indicates acceptance of condition of components to which work will be applied.

1.5 FIELD VERIFICATION

A. Shop Drawings:
   1. Verify or correct Shop Drawing dimensions with field measurements prior to submission.
   2. If requested, assist Engineer in rechecking field measurements.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 71 23

SECTION 01 73 29 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for cutting and patching work.

B. Requirements:
   1. Cutting and patching may be described in various Sections of these Specifications
   2. Execute cutting, including excavating and filling, or patching of work required to:
      a. Make several parts fit properly.
      b. Uncover work to provide for installation of ill-timed work.
      c. Remove and replace defective work.
      d. Remove and replace work not conforming to the requirements of the Contract Documents.
      e. Remove Samples of the installed work as specified for testing.
      f. Install specified work in existing construction.

C. Requirements Upon Engineer's Instructions:
   1. In addition to Contract requirements, upon written instruction of Engineer:
      a. Uncover work to provide for Engineer's observation of covered work.
      b. Remove Samples of installed materials for testing.
      c. Remove work to provide for alteration of existing work.

D. Protection of Work:
   1. Do not endanger any work by cutting or altering the work or any part of it.
   2. Do not cut or alter the work of another trade without written consent of Engineer.

1.3 SUBMITTALS

A. Written Notice:
   1. Prior to cutting which may affect the structural integrity of the Project or the work of another trade, submit written notice to Engineer requesting consent to proceed with cutting.
   2. Required Information:
      a. Identification of Project.
      b. Description of all related defective work.
      c. Necessity for cutting.
      d. Effect on other work or on the structural integrity of the Project.
      e. Description of the proposed work including:
         1) Scope of cutting and patching.
         2) Subcontractor and trades to execute work.
         3) Products proposed to be used.
         4) Extent of refinishing.
      f. Alternatives to cutting and patching.
      g. Designation of party responsible for the cost of cutting and patching.

B. Changes of Materials or Methods:
   1. Should conditions of the Work, or the schedule, indicate change of materials or methods, submit a written recommendation to Engineer including:
      a. Conditions indicating the change.
      b. Recommendations for alternative materials or methods.
      c. Submittals as required for substitutions.

C. Uncovered Work: Submit written notice to Engineer designating the time work will be uncovered to provide for observation.

1.4 DIVISION OF WORK

A. Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
      a. Each trade shall be financially responsible for all cutting and patching for sleeves, penetrations and installation of isolated components as necessary for its work unless herein specifically stated to the contrary.
      b. On renovation projects, Contractor shall cut and patch walls, floors, ceilings to allow for continuous runs of recessed utilities and ductwork.
      c. All patching shall be done by the trade whose work is damaged.
      d. Any cost caused by defective or ill-timed work shall be borne by the party responsible.
      e. Each trade shall do all fitting of its own work as required to make its several components fit together or to receive the work of other contractors.
      f. Holes cut in exterior walls or roofs for installation of mechanical or electrical equipment shall be waterproofed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All materials and workmanship shall conform to the requirements of other Sections of the Specifications. Where no materials are specified in these specifications, use materials of an equivalent type, quality, and size to match those existing in other areas of the facility. If none exist, use materials and workmanship recognized as of the highest quality in the industry. Obtain Engineer's review of all such material and workmanship.

PART 3 - EXECUTION

3.1 INSPECTION

A. Existing Conditions: Inspect existing conditions of the Work, including elements subject to movement or damage during cutting and patching or excavating and backfilling.

B. Uncovered Work: After uncovering work, inspect conditions affecting the installation of new Products.

3.2 PREPARATION

A. Shoring and Bracing: Provide shoring, bracing and support as required to maintain structural integrity of the Project.

B. Protection: Provide protection for other portions of the Project and provide protection from the elements.

3.3 PERFORMANCE

A. Adjustments to Products: Execute fitting and adjustments of Products to provide finished installation.

B. Refinishing:
   1. Prepare existing surfaces for finishes by scraping, sanding, filling, acid etching, and sand blasting to ensure bonding and a smooth finish.
   2. Refinish entire surfaces as necessary to provide an even finish.
   3. Refinish continuous surfaces to the nearest intersection.
   4. Refinish entire assemblies.

3.4 CLEANING

A. Clean materials installed under this Section in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 01 73 29

SECTION 01 74 00 – CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for maintaining structures and the Site in a standard of cleanliness.

B. Related Sections: In addition to standards described in this Section, comply with requirements for cleaning as described in various other Sections of these Specifications.

1.3 QUALITY ASSURANCE

A. Inspection:
   1. Daily and more often if necessary.
   2. Conduct inspections to verify that requirements of cleanliness are being met.

1.4 DELIVERY, STORAGE AND HANDLING

A. Hazards Control:
   1. Volatile Wastes:
      a. Store in covered metal containers.
      b. Remove from premises daily.
      c. Provide secondary containment for storage of hazardous materials, as required by governing authorities or agencies.
   2. Prevent accumulation of wastes which create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.
   4. Hazardous material inspection and removal/disposal are contractor responsibility

1.5 PROJECT CONDITIONS

A. Cleaning and Disposal:
   1. Conduct operations to comply with local ordinances and anti-pollution laws.
   2. Not Allowed:
      a. Burning or burying of rubbish or waste materials on Site.
      b. Disposal of volatile wastes in storm or sanitary sewers: Volatile wastes include, but are not limited to, mineral spirits, oil or paint thinner.
      c. Disposal of wastes into streams or waterways.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Compatibility:
   1. Compatible with the surface being cleaned.
   2. Recommended by the Manufacturer of the material being cleaned.
   3. As reviewed by Engineer.

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. General:
1. Store Materials:
a. In an orderly arrangement allowing maximum access.
b. To allow unimpeded drainage and traffic.
c. Provide for the required protection of materials.
2. Do not allow accumulation of scrap, debris, waste material and other items not required for construction of the Work.
.
a. Remove from Site at least each week and more often if necessary.
b. Provide adequate storage for materials awaiting removal.
3. Observe requirements for fire protection and protection of the environment.

B. Site:
1. Daily, and more often if necessary:
a. Inspect the Site.
b. Pick up scrap, debris and waste material; remove such items to the place designated for their storage.
2. Weekly, and more often if necessary:
a. Inspect arrangements of materials stored on Site.
b. Restack or otherwise service arrangements to meet the requirements of paragraph 3.1.A.1 above.
3. At all times maintain the Site in a neat and orderly condition which meets the approval of Engineer.
4. Paved Surfaces: Keep clean.
5. Dust Control:
a. Control dust on or near the Work by the application of water, or other approved means.
b. If Contractor fails to correct unsatisfactory conditions with 24 hours after due notification:
1) Owner may arrange for such work to be performed by other means.
2) Pay costs.

C. Buildings, Tanks, and Other Structures:
1. Weekly, and more often if necessary:
a. Inspect.
b. Pick up scrap, debris and waste material; remove such items to the place designated for their storage.
c. Sweep interior spaces clean. Clean shall be defined to be free from dust and other material capable of being removed by reasonable diligence using a hand-held broom.
2. Preparation for installation of succeeding material:
a. Clean the building, tank or other structure or pertinent portion thereof:
1) To the degree of cleanliness recommended by the Manufacturer of the succeeding material.
2) Using equipment and materials required to achieve the required cleanliness.
3. After installation of finish floor material:
a. Clean the finish floor daily at all times while work is being performed in the space in which finish materials have been installed.
1) Clean as used above shall be defined to be free from all foreign material which, in the opinion of Engineer, may be injurious to the finish floor material.
4. Schedule cleaning operations so that dust and other contaminants resulting from cleaning operations will not fall on wet, recently painted surfaces.

3.2 FINAL CLEANING

A. Definitions for Clean: The level of cleanliness generally provided by commercial building maintenance subcontractors using commercial quality building maintenance equipment and materials.

B. Prior to Completion of the Work:
1. Remove from the Site all tools, surplus materials, equipment, scrap, debris and waste.
2. Conduct final progress cleaning as described in Article 3.1 above.

C. Site:
   1. Unless otherwise specifically directed by Engineer:
      a. Hose down paved areas on Site and public sidewalks directly adjacent to the Site.
      b. Rake clean other surfaces of the grounds.
   2. Remove resultant debris.

D. Buildings, Tanks and Other Structures:
   1. Exterior:
      a. Visually inspect exterior surfaces.
      b. Remove traces of soil, waste material, smudges and other foreign matter.
      c. Remove traces of splashed materials from adjacent surfaces.
      d. If necessary to achieve a uniform degree of exterior cleanliness, hose down the exterior surface.
      e. In the event of stubborn stains not removable with water, Engineer may require light sandblasting or other cleaning at no additional cost to Owner.
   2. Interior:
      a. Visually inspect interior surfaces.
      b. Remove traces of soil, waste material, smudges and other foreign matter.
      c. Remove traces of splashed materials from adjacent surfaces.
      d. Remove paint droppings, spots, stains and dirt from finished surfaces using only the specified cleaning materials and equipment.
   3. Glass: Clean glass inside and outside.
   4. Polished Surfaces: To surfaces requiring the routine application of buffed polish, apply the specified polish as recommended by the Manufacturer of the material being polished.

E. Timing: Schedule final cleaning as approved by Engineer to enable Owner to accept a completely clean Project.

3.3 OWNER OCCUPANCY PRIOR TO SUBSTANTIAL COMPLETION AND ACCEPTANCE

A. If Owner occupies the Work, or a portion of the Work, prior to Substantial Completion and acceptance, then the responsibilities for interim and final cleaning shall be determined by Engineer in accordance with the Contract Documents.

END OF SECTION 01 74 00

SECTION 01 74 26 – DISINFECTION OF DRINKING WATER FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes disinfection of drinking water facilities.

B. Disinfection of Other Components:
   1. Procedures for the disinfection of individual piping systems or of certain project components may be specified elsewhere in these specifications.
   2. Coordinate the work of this Section with the disinfection requirements specified elsewhere.

1.3 DELIVERY

A. Pipes:
   1. Clean inside when delivered to Site.
   2. Stored in a manner to maintain the interior of pipe in clean condition.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 BUILDING PIPES

A. Disinfection: In accordance with:
   1. Division 22 Section “Plumbing Pumps.”
   2. Division 40 Section “Process Piping Systems.”

3.2 SITE PIPES

A. Disinfection: In accordance with:
   1. Division 33 Section “Water Utilities.”
   2. Division 33 Section “Site Process Piping Systems.”

3.3 TREATMENT FACILITIES

A. Cleaning:
   1. Remove debris from completed facilities which will be in contact with potable drinking water.
   2. Thoroughly clean interior walls of facilities which will contact potable drinking water of all dirt, grease, and other contaminants.

B. Disinfection and Sampling:
   1. Apply chlorine at rate of 50 mg/l and allow contact for 12 hours.
   2. Thoroughly flush unit or facility until chlorine residual is at background level of water source used for flushing.
   3. Collect duplicate samples from the vessel being disinfected not less than 30 minutes apart.
   4. Place vessel in service if results of bacteriological analyses are satisfactory.

5. If sample results are not satisfactory, before placing unit or facility in service:
   a. Take repeat samples at least 24 hours apart until consecutive samples do not show the presence of coliform, or
   b. Repeat the disinfection procedure.
6. Place unit or facility in service upon receipt of satisfactory test results.

3.4 STORAGE TANKS

A. Cleaning:
   1. Remove all debris from tank interior which will be in contact with potable drinking water.
   2. Thoroughly clean interior walls which will contact potable drinking water of all dirt, grease, and other contaminants.

B. Disinfection:
   1. Prepare chlorine solution of at least 200 mg/l to be applied directly to the walls of the tank with suitable brushes or spray equipment.
   2. The strong chlorine solution shall stay in contact with the surfaces to be disinfected for at least 30 minutes; then fill the tank with potable water to its overflow level and collect samples for bacteriological quality analysis.
   3. If samples are satisfactory in quality, the water in the tank may be pumped to the distribution system for use as long as the aesthetic quality is acceptable as determined by Engineer.
   4. Results to be reviewed by Engineer if analyses are unacceptable.
   5. If sample results are not satisfactory, redisinfect as directed by Engineer.
   6. Place in service only after 2 consecutive acceptable bacteriological analyses.

END OF SECTION 01 74 26

SECTION 01 75 00 – STARTING AND ADJUSTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes provisions for facility startup and demonstration of the following systems:
   1. Equipment.
   2. Mechanical Systems.
   3. Process Equipment.

1.3 SUBMITTALS

A. Preliminary Schedules:
   1. Submit 2 weeks prior to earliest proposed date.
   2. List time and date for the following for each system:
      a. Start-up.
      b. Demonstration.

B. Completion Reports:
   1. Submit within 1 week after each system demonstration.
   2. List time, date and persons present for the following for each system:
      a. Start-up.
      b. Demonstration.
   3. Include Manufacturer's representative's report indicating:
      a. Approval of installation.
      b. Satisfactory start-up.
      c. Functioning correctly.
   4. Indicate that demonstration and instructions were satisfactorily completed.

1.4 QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Provide when required by individual Section.
   2. Provide the following services except where indicated otherwise in individual Sections.
      a. Inspect, check and approve system installation.
      b. Supervise system start-up.
      c. Provide written report indicating that system:
         1) Has been properly installed and lubricated.
         2) Is in accurate alignment.
         3) Is free from undue stress imposed by connecting lines or anchor bolts.
         4) Has been satisfactorily operated under full load conditions.
      d. Demonstrate operation of system to Owner's personnel.
      e. Instruct Owner's personnel on operation and maintenance of system.

1.5 PROJECT CONDITIONS

A. Verify that:
   1. Excess packing and shipping bolts have been removed.
   2. Interdependent systems have been checked and are operational.

1.6 CORRECTION PERIOD

A. Provide periodic continuing warranty services as necessary to ensure proper functioning of mechanical systems after occupancy of the Project, and for a period of 1 year after date of Substantial Completion.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 STARTING OF SYSTEMS

A. Inspection:
   1. Verify that Project conditions comply with requirements.
   2. Verify that status of Work meets requirements for starting of systems.

B. Preparation:
   1. Coordinate sequence for start-up of various systems.
   2. Notify Engineer 7 days prior to start-up of each system.
   3. Have at hand during entire start-up process:
      a. Contract Documents.
      b. Shop Drawings.
      c. Product data.
      d. Operation and maintenance data.
   4. Verify that each piece of equipment has been checked for:
      a. Proper lubrication.
      b. Drive rotation.
      c. Belt tension.
      d. Control sequence.
      e. Other conditions which may cause damage.
   5. Verify control systems are fully operational in automatic mode.
   6. Verify that tests, meter readings and specific electrical characteristics agree with those specified by electrical equipment Manufacturer.
   7. Bearings:
      a. Inspect for cleanliness, clean and remove foreign materials.
      b. Verify alignment.
      c. Replace defective bearings and those which run rough or noisy.
      d. Grease as necessary and in accordance with Manufacturer's recommendations.
   8. Drives:
      a. Adjust tension in V-belt drives, and adjust vari-pitch sheaves and drives for proper equipment speed.
      b. Adjust drives for alignment of sheaves and V-belts.
      c. Clean, remove foreign materials before starting operation.
   9. Motors:
      a. Check each motor for amperage comparison to nameplate value.
      b. Correct conditions which produce excessive current flow and which exist due to equipment malfunction.
   10. Pumps:
      a. Check mechanical seals for cleanliness and adjustment before running pump.
      b. Inspect shaft sleeves for scoring.
      c. Inspect mechanical faces, chambers and seal rings; replace if defective.
      d. Verify that piping system is free of dirt and scale before circulating liquid through the pump.
      e. Check Pump Performance:
         1) Install a pressure gage on the discharge side of the check valve following pump.
         2) Operate the pump at all system operating heads.
            a) Verify pump operation with the Manufacturer's pump curve.
            b) Report deviations to Engineer.

3) Operate the pump through several cycles while observing the pressure gage.
a) Watch pressure gage for several minutes after pump shut down.
b) Report significant pressure variations to Engineer.
4) Remove pressure gage and plug tap.

11. Control Valves:
a. Inspect both hand and automatic control valves; clean bonnets and stems.
b. Tighten packing glands to ensure no leakage, but permit valve stems to operate without galling.
c. Replace packing in valves to retain maximum adjustment after system is judged complete.
d. Replace packing on any valve which continues to leak.
e. Remove and repair bonnets which leak.
f. Coat packing gland threads and valve stems with a surface preparation of "Moly-Cote" or "Fel-Pro" after cleaning.
g. Verify that control valve seats are free from foreign material and are properly positioned for intended service.
12. Flanges:
a. Tighten flanges after system has been placed in operation.
b. Replace flange gaskets which show any sign of leakage after tightening.
13. Screwed Joints:
a. Inspect screwed joints for leakage.
b. Promptly remake each joint which appears to be faulty; do not wait for rust to form.
c. Clean threads on both parts, apply compound and remake joints.
14. Fan Wheels:
a. Inspect fan wheels for clearance and balance.
b. Provide factory-authorized personnel for adjustment when needed.
15. Control Circuits:
a. Check each electrical control circuit to ensure that operation complies with Specifications and requirements to provide desired performance.
16. Pressure Gages:
a. Inspect each pressure gage and thermometer for calibration.
b. Replace items which are defaced, broken or which read incorrectly.
17. Repair damaged insulation.
18. Venting and Drainage:
a. Vent gases trapped in any part of systems.
b. Verify that liquids are drained from all parts of gas or air systems.
19. Leaks: Check piping for leaks at every joint and at every screwed, flanged or welded connection using "Leak-Tek" or other approved compound.
20. Cleaning:
a. After system has been placed in operation, clean strainers, dirt pockets, orifices, valve seats and headers in fluid systems, to ensure being free of foreign materials.
b. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.

C. Start-up:
1. Execute start-up under supervision of responsible persons in accordance with Manufacturer's instructions.
2. Place equipment in operation in proper sequence.

3.2 SYSTEMS DEMONSTRATION

A. Preparation:
1. Verify that system:
a. Has been inspected and put in service.
b. Is fully operational.
2. Operation and Maintenance Manuals:
a. Completed.
b. Sufficient copies available for use in demonstrations and instructions.

B. Demonstrations and Instructions:
1. Demonstration of and instruction on operation and maintenance of system:
a. To Owner's personnel.
b. Two weeks prior to Substantial Completion.

2. Equipment requiring seasonal operation: Demonstrate within 12 months.
3. Instruction:
   a. Operation and maintenance manual as basis.
   b. Review contents of manual in detail.
   c. Explain all aspects of operation and maintenance.
4. Demonstrate:
   a. Start-up.
   b. Operation.
   c. Control.
   d. Adjustment.
   e. Troubleshooting.
   f. Servicing.
   g. Maintenance.
   h. Shutdown.

3.3 PERFORMANCE TEST

A. Performance Test:
   1. Test the entire Work, including all of its individual systems for 2 weeks before final payment will be made.
   2. Make final tests in the presence of Owner and Engineer.
   3. If any part of the Work or equipment does not meet Specifications:
      a. Correct the situation.
      b. Obtain approval of Engineer before final payment is made.
   4. Provide the personnel and bear all costs for correcting all malfunctions.
   5. Owner will provide operating personnel and utilities.

END OF SECTION 01 75 00

SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the instructions for and the responsibilities of each party in contract closeout.

B. Related Section includes Certificate of Substantial Completion.

1.3 SUBSTANTIAL COMPLETION

A. Contractor: When Contractor considers that the Work or any portion of the Work is ready for its intended use, Contractor shall submit:
   1. Written certification to Engineer and Owner that the Work, or designated portion of the Work, is substantially complete.
   2. A list of major items to be completed or corrected.
   3. Request that Engineer issue a certificate of Substantial Completion.

B. Engineer's Inspection: Engineer will make an inspection:
   1. Within 10 days after receipt of certification.
   2. Together with Owner and Contractor.

C. Engineer's Determination of Substantial Completion:
   1. Should Engineer consider the Work or designated portion of the Work substantially complete, the following steps shall be taken:
      a. Contractor shall prepare and submit to Engineer, a list of items to be completed or corrected as determined by the inspection.
      b. Engineer will prepare and deliver to Owner:
         1) A tentative certificate of Substantial Completion.
         2) A tentative list of items to be completed or corrected before final payment.
      c. Owner shall have 7 days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list.
      d. Engineer will, within 14 days after delivery of tentative certificate to Owner, decide:
         1) Not Substantially Complete: Engineer will issue written notice to Contractor stating reasons.
         2) Substantially Complete: Engineer will issue definitive certificate of Substantial Completion and a revised list of items to be corrected or completed.
   2. Should Engineer consider that the Work or designated portion of the Work is not substantially complete, the following steps shall be taken:
      a. Engineer shall notify Contractor in writing stating Engineer's reasons.
      b. Contractor shall complete the Work and send a second written notice to Engineer certifying that the Project, or designated portion of the Project, is substantially complete.
      c. Engineer and Owner will reinspect the Work.

D. Division of Responsibilities:
   1. Engineer:
      a. At the time of delivery of tentative certificate of Substantial Completion.
      b. Deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment with respect to:
         1) Security.
         2) Operation.
         3) Safety.
         4) Protection of the Work.
         5) Maintenance.

6) Heat.
7) Utilities.
8) Insurance.
9) Warranties.

2. Engineer's written recommendation on division of responsibilities shall be binding on Owner and Contractor until final payment unless Owner and Contractor agree otherwise in writing and so notify Engineer prior to Engineer's issuance of a definitive certificate of Substantial Completion.

1.4 FINAL INSPECTION

A. Contractor Certification: Prior to final inspection, Contractor shall submit written certification that:
1. The Contract Documents have been reviewed.
2. The Project has been inspected in compliance with the Contract Documents.
3. Work has been completed in accordance with the Contract Documents.
4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
5. The Project is complete and ready for final inspection.

B. Engineer's Inspection: The Engineer will make final inspection:
1. Within 10 days after receipt of certification.
2. Together with Owner and Contractor.

C. Engineer's Determination of Final Completion:
1. Should Engineer consider the Work complete and ready for final payment in accordance with the requirements of the Contract Documents, Engineer shall request Contractor to make Project closeout submittals.
2. Should Engineer consider the Work not complete and ready for final payment:
a. Engineer shall notify Contractor in writing stating the reasons.
b. Contractor:
1) Take immediate steps to remedy the stated deficiencies.
2) Send a second written notice to Engineer certifying that the Work is complete.
c. Engineer and Owner will reinspect the Work.

1.5 REINSPECTION COSTS

A. Should Engineer be required to perform second inspections because of failure of the Work to comply with the original certifications of Contractor, Owner will compensate Engineer for additional services and deduct the amount paid from payment or payments to Contractor.

1.6 ADDITIONAL INSPECTION COSTS

A. Substantial Completion: Owner will compensate Engineer for inspection services rendered between the scheduled date of Substantial Completion and the actual date of Substantial Completion and deduct the amounts paid from payment or payments to Contractor.

B. Final Completion: Owner will compensate Engineer for inspection services rendered between the scheduled date of final completion and the actual date of final completion and deduct the amounts paid from payment or payments to Contractor.

1.7 CLOSEOUT SUBMITTALS

A. Contractor:
1. Provide closeout submittals as required in the Contract Documents.
2. These submittals shall include, but not necessarily be limited to:
a. Project record documents.
b. Operation and maintenance manuals.
c. Guarantees.
d. Spare parts and maintenance materials.
e. Instruction in operation of all systems.

1.8 EVIDENCE OF PAYMENTS AND RELEASE OF LIENS

A. Affidavits:
   1. Submit with final Application for Payment an affidavit of payment of debts and release of claims.
   2. Affidavit shall include:
      a. Contractor's release or waiver of lien.
      b. Consent of surety of final payment.

B. Execution: All submittals shall be duly executed before delivery to Engineer.

1.9 FINAL ADJUSTMENT OF ACCOUNTS

A. Final Statement: Submit a final statement of accounting, which reflects all adjustments, to Engineer. This statement shall contain the following:
   1. Original Contract Price.
   2. Additions and deductions.
   3. Total Contract Price as adjusted.
   4. Previous payments.
   5. Sum remaining due.

B. Final Change Order: Engineer will prepare a final Change Order reflecting approved adjustments to the Contract Price not previously made by Change Orders.

1.10 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit a final Application for Payment in accordance with the requirements of the Contract Documents.

B. Disposition of Final Application for Payment:
   1. If the final Application for Payment and the Work are acceptable in accordance with the Contract Documents:
      a. Engineer will, within 10 days after receipt of the Application for Payment:
         1) Submit to Owner a written recommendation for payment.
         2) Submit to Owner and Contractor a written notice that the Work is acceptable subject to the provisions of the General Conditions.
      b. Owner will, within 30 days after receipt of the Application for Payment and Engineer's recommendation in accordance with the Contract Documents, pay to Contractor the amount recommended.
   2. If the Application for Payment, the Work or both are unacceptable:
      a. Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment.
      b. Contractor shall make the necessary corrections and resubmit the Application for Payment.
   3. Final Completion Delayed:
      a. Upon receipt of Contractor’s final Application for Payment and recommendation by Engineer, Owner shall make payment of the balance due for that portion of the Work fully completed and accepted if Engineer confirms that final completion of the Work is significantly delayed through no fault of Contractor.
      b. Payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.
      c. Contractor shall submit with the Application for Payment written consent of surety if the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 77 00

SECTION 01 78 39 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes procedures for the maintenance, recording and submittal of Project record documents.

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

A. Storage:
   1. Store documents and Samples in Contractor's field office apart from documents used for construction.
   2. Provide files and racks for storage of documents.
   3. Provide locked cabinet or secure storage space for storage of Samples.

B. Filing: File record documents in accordance with CSI Masterformat.

C. Maintenance:
   1. Maintain documents in a clean, dry, legible condition and in good order.
   2. Do not use record documents for construction purposes.

D. Availability: Make documents and Samples available at all times for inspection by Engineer.

1.4 RECORDING

A. Labeling: Label each document "PROJECT RECORD" in neat large printed letters.

B. Recording:
   1. Record actual revisions to the Work.
   2. Record information concurrently with construction progress.
   3. Do not conceal any work until required information is recorded.

C. Drawings:
   1. Legibly mark, with notes or graphic representations, to record actual construction.
      a. Depths of various elements of foundation in relation to approved datum.
      b. Horizontal and vertical locations of Underground Facilities and appurtenances, referenced to permanent surface improvements.
      c. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
      d. Field changes of dimension and detail.
      e. Changes made by Field Order, Work Change Directive or Change Order.
      f. Details not on original Contract Drawings.

D. Specifications and Addenda:
   1. Legibly mark each Section to record:
      a. Manufacturer, trade name, catalog number, and Supplier of each Product and item of equipment actually installed.
      b. Changes made by Field Order, Work Change Directive or Change Order.

1.5 SUBMITTAL

A. Delivery:
   1. At Contract closeout, deliver record documents to Engineer for Owner.
   2. Submit only Contract Documents marked up. Three dimensional models, shop drawings, or other representations of the Project created by the Contractor from the Contract Documents will not be accepted.

B. Transmittal Letter:
   1. Accompany submittal with transmittal letter in duplicate, containing:
      a. Date.
      b. Project title and number.
      c. Contractor's name and address.
      d. Title and number of each Record Document.
      e. Signature of Contractor or their authorized representative.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 01 78 39

SECTION 02 41 00 – DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the demolition of existing pipes, concrete structures and building associated.

1.3 REFERENCES

A. Except as herein specified or as indicated on Drawings, the work of this Section shall comply with the following:
   1. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.4 DEFINITIONS

A. Terms:
   1. Abandon: Remove an item to the extent that it is not visible and does not interfere with new construction. Portions of the abandoned item may be left in place. No abandoned items shall be left below new footings.
   2. Demolish: Remove existing items from their present location in the Project area and haul to an area outside of the Project area. Remove utilities serving these items.
   3. Relocate: Move existing items from their present location to another location in the Project area. Extend utilities serving the present location to the new location.
   4. Remove: Remove existing items from their present location in the Project area and haul to an area outside of the Project area. Remove utilities serving these items.
   5. Replace: Remove existing items from their present location in the Project area, haul them to an area outside of the Project area, and furnish and install new items in the same or another location. Extend utilities serving the present location to the new location.
   6. Reuse: Move existing items from their present location to another location in the Project area. Extend utilities serving the present location to the new location.

1.5 PROTECTION

A. Comply with requirements of NFPA 241.

B. Existing Structures:
   1. Demolition and disassembly will not be allowed until it is coordinated with Owner's operations.
   2. Maintain free and safe passage to and from buildings.
   3. Prevent movement or settlement of structures.
   4. Provide and place bracing, shoring and underpinning, and be responsible for safety and support of structures and assume liability for such movement, settlement, damage or injury.
   5. Cease operations and notify Engineer immediately if safety of structure appears to be endangered. Take precautions to properly support structure. Do not resume operations until safety is restored.
   6. All active utility mains traversing the project site shall be maintained.
   7. Do not close or obstruct any streets, sidewalks, alleys or passageways unless specifically authorized.

C. Barricades:
   1. Provide, erect and maintain barricades, lighting and guard rails as required by applicable regulatory agencies to protect occupants of building and workers.
   2. Provide temporary fencing for security if it is necessary to temporarily remove Owner's security fencing for access to the site. Obtain Owner's approval prior to removing any existing fencing.

D. Coordination With Local Authorities:
   1. Cooperate with local authorities and utility companies whose work affects or will be affected by the demolition operations. Ascertain the rules, regulations and requirements of these authorities which affect the demolition process; notify them of conditions affecting their work. Disconnect or arrange for disconnection of utility services if required.
   2. Comply fully with all provisions of the local codes, laws and ordinances applicable to work of this Section.

1.6 SUBMITTALS

A. Upon request, submit to Engineer for review 2 copies of proposed methods and operations of demolition of the structures and modifications specified herein prior to the start of work. Include in the submittal a schedule for the coordination of shutoff, capping and continuation of utility services as required.

B. Provide a detailed sequence of demolition, disassembly and removal work to ensure the uninterrupted progress of Owner's operations.

1.7 SEQUENCING AND SCHEDULING

A. Scheduling:
   1. Before commencing demolition work, complete all modifications necessary to bypass the affected structure.
   2. Actual work shall not begin until Engineer has inspected and approved the modifications and authorized commencement of the demolition work.
   3. Follow this procedure for each individual demolition operation.

PART 2 - PRODUCTS

2.1 SALVAGED MATERIALS

A. Ownership:
   1. Owner shall have the option of retaining ownership of any or all existing equipment, materials, and items removed under this Work.
   2. Should Owner decide not to retain ownership of certain items removed under the work of this Section, those items shall become property of Contractor and shall be promptly removed from the Project Site.

B. Deliver items which remain property of Owner to a location, as selected by Owner.

2.2 MATERIALS

A. Weatherproof Closures: Polyethylene sheets or plywood.

B. Temporary Protective and Dustproof Partitions: Plywood and 2 x 4 wood studs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Permits: Obtain all necessary permits.

B. Weatherproof Closures:
   1. Erect weatherproof closures for exterior openings.
   2. Maintain exit requirements.

C. Temporary Dustproof and Protective Partitions:
   1. Erect temporary partitions separating construction areas from occupied areas to prevent spread of dust, fumes and smoke to other parts of the building and to protect occupants from falling debris.
   2. Construct temporary corridor walls and ceilings within construction areas to give occupants access to exits, toilet rooms, etc.
   3. On completion, remove partitions and repair damaged surfaces to match adjacent surfaces.

D. Be responsible for all safety requirements in accordance with the General Conditions.

E. Carry out demolition work to cause as little inconvenience to existing occupied building areas as possible.

3.2 DEMOLITION

A. General:
1. Repair all demolition performed in excess of that required at no cost to Owner.
2. Do not use explosives in the work.
3. Remove all demolished concrete, masonry and other debris completely from within new building areas.
4. Remove concrete walls and other debris 2 feet below finished grade outside of new building areas and 3 feet below bottom of footings within building limits.
5. Remove all mechanical, electrical, piping and miscellaneous equipment and appurtenances before commencing structural demolitions.
6. Patch and repair existing surfaces from which items have been removed leaving holes, fasteners and surface blemishes exposed to view.

B. Wells: Properly abandon existing wells where indicated on the Drawings and in accordance with all applicable State of Michigan laws and regulations.

C. Burning: Do not burn materials on Site.

D. Specific Items of Demolition: Listing of the following items is made solely for convenience and does not imply a complete schedule of demolition for this project. Refer to Drawings for extent and locations of various items of demolition work. Also, verify conditions at the Site:
1. Digesters covers and equipment.
2. Existing roofing and insulation.
3. Piping and valves.
4. Masonry from new openings.
5. Existing sludge drying beds.
6. Comminutor, bar rack and bucket elevator at pumping station.
7. Chlorination equipment.
8. Existing manhole and sump.
9. Existing laboratory and office.
10. Clarifier equipment.
11. Building floor slabs.
12. Existing chlorine monorail.
13. Existing doors.
14. Digester overflow box.
15. Boiler, fin tube radiation, water heater, unit heater, exhaust fan, plumbing fixtures, piping and related material in existing control building.
16. Two existing wells.

E. Disposal of Materials:
1. Remove contaminated, dangerous and others materials from Site and dispose of in accordance with applicable regulations.
2. Pay for all hauling, storage, collection and disposal costs.
3. Hazardous material inspection and removal/disposal are contractor responsibility.

3.3 DISASSEMBLY

A. General:
1. Carefully disassemble, identify and catalog all parts of structures to be disassembled.
2. Submit a listing of parts which is complete and adequate to facilitate easy reassembly of structures.
3. Take all practicable precautions so as not to damage materials during disassembly and transport.
4. Promptly move all materials.

B. Items of Disassembly:
1. Refer to the Drawings for locations of the buildings.
2. Verify conditions at the Site and coordinate specific items of disassembly with Engineer.

3.4 CLEANING

A. Clean affected areas in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 02 41 00

SECTION 03 15 16 – POST-INSTALLED ANCHORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of post-installed anchors.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following pertinent provisions:
   1. ASTM:
      a. A36 - Carbon Structural Steel.
      b. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.
      c. A198 - Steel Bolting Materials for High-Temperature Service.
      d. A240 - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
      e. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
      f. A510 - General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel.
      g. A563 - Carbon and Alloy Steel Nuts.
      h. B633 - Electrodeposited Coatings of Zinc on Iron and Steel.
      i. E488 - Strength of Anchors in Concrete and Masonry Elements.
      j. E1512 - Testing Bond Performance of Bonded Anchors.
      k. F436 - Hardened Steel Washers.
      l. F593 - Stainless Steel Bolts, Hex Cap Screws, and Studs.
      m. F594 - Stainless Steel Nuts.
      n. F844 - Washers, Steel, Plain (Flat), Unhardened for General Use.
   2. ACI:
      a. 318, Chapter 17 - Anchoring to Concrete.
      b. 355.2 - Qualification of Post-Installed Mechanical Anchors in Concrete.
      c. 355.4 - Qualification of Post-Installed Adhesive Anchors in Concrete.
   3. International Code Congress Evaluation Service - ICC-ES:
      a. AC-193 - Mechanical Anchors in Concrete Elements.
      b. AC-308 - Post-installed Adhesive Anchors in Concrete Elements.
   4. Michigan Building Code.

1.4 SUBMITTALS

A. Product Data: For each anchor type to be furnished for each base material to which it will be fastened, including:
   1. Anchor specific type, physical properties and installation procedures.
      a. General catalog sheets of anchors without specific reference are not acceptable.
   2. Strength developed by anchor in each base material to which each is being fastened.
   3. Anchor embedment depth in base material.
   4. Anchor material.
   5. ICC-ES Report for each specific anchor indicating compliance to applicable building code.

1.5 QUALITY ASSURANCE

A. Provide special inspections of post-installed anchors in accordance with Division 01 Section “Special Inspections and Tests.”

B. Compliance:
   1. Mechanical anchors shall comply with AC-193 and ACI 355.2.
   2. Adhesive anchors shall comply with AC-308 and ACI 355.4.

C. Installation Personnel Qualifications:
   1. Knowledgeable of the specific Manufacturer's requirements for proper installation of post-installed anchors.
   2. Anchor installers shall be properly trained by the anchor Manufacturer on Site.
      a. Anchor Manufacturer's representative shall not be a distributor or third party.
      b. The installers to be trained shall be the actual person or persons installing the anchors, not the foreman, superintendent or similar supervisory personnel.
      c. The on Site training shall include training for installation of each anchor in each substrate on the Project for each trade.
      d. Each person installing the anchor shall be trained.
      e. Anchor installation training shall take place prior to the installation of the anchors. The installer shall have training verification available for review at any time.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Hilti.

B. Products of the following manufacturers are among those which may be considered equal based on Submittals reviewed by Engineer; approval or rejection of the proposed or equal will be at Engineer's sole discretion:
   1. Powers/Rawl.
   2. Redhead.
   3. Simpson.

C. If Contractor intends to substitute other than Basis of Design products, Contractor shall be responsible to submit substitution product data that proves equivalence including, but not limited to:
   1. Capacities for specific anchor sizes, embedment lengths, and base materials into which the anchor will be fastened.
   2. Capacity reduction factors for spacing and edge distance.
   3. Material of each anchor type.
   4. ICC ES report applicable to each anchor type.

2.2 MATERIALS

A. Actual or Potential Ambient Conditions:
   1. Submerged or Corrosive Environment: Stainless steel in accordance with ASTM F593.
   2. Dry Areas: Mild steel, galvanized in accordance with ASTM B633, SC1, Type III.

2.3 POST-INSTALLED ANCHORS

A. Anchors that Resist Loads Through Mechanical Friction or Keying Forces:
   1. Expansion Anchors Approved for Use in Cracked Concrete:
      a. Wedge style anchor.
      b. Hilti Kwik Bolt TZ2 (ICC-ESR 4266).
      c. Capable of sustaining an ultimate load of 4 times the imposed load capacity in concrete when tested in accordance with ASTM E488.
   2. Expansion Anchors Approved for Use in Uncracked Concrete:
      a. Wedge style anchor.
      b. Hilti Kwik Bolt TZ2 (ICC-ESR 42660.
      c. Capable of sustaining an ultimate load of 4 times the imposed load capacity in concrete when tested in accordance with ASTM E488.
   3. Undercut Anchors Approved for Use in Cracked and Uncracked Concrete:
      a. Expanding sleeve, self-undercutting wedge style anchor.
      b. Hilti HDA (ICC-ESR 1546).

c. Hex or flat head anchor or threaded anchor with hex nut as situation requires or as indicated on the Drawings.

4. Screw Style Anchors Approved for Use in Cracked Concrete:
   a. Hilti Kwik HUS EZ (ICC-ESR 3027).
   b. Capable of sustaining an ultimate load of 4 times the imposed load capacity in concrete when tested in accordance with ASTM E488.
5. Expansion Anchors Approved for Use in Solid Grouted Masonry:
   a. Wedge style anchor.
   b. Hilti Kwik Bolt TZ2 (ICC-ESR 4561).
6. Screw Style Anchors Approved for Use in Solid Grouted Masonry:
   a. Hilti Kwik HUS EZ (ICC-ESR 3056).

B. Anchors that Resist Loads Through an Injectable Chemical Adhesive:
1. In Concrete: Hilti HIT HY 200 Safe Set.
2. In Solid Grouted Masonry: Hilti HIT-HY 270.
3. In Hollow Brick or Hollow Masonry: Hilti HIT-HY 270 with screen tubes.
4. Anchored Material: Carbon steel or stainless steel threaded rods or deformed reinforcing bars as specified herein or as indicated on the Drawings.
5. Bonding Strength: Tested in accordance with ASTM E1512.
6. If installation temperatures of base materials fall below 41 degrees F, review cold weather applications with Manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install post-installed anchors:
1. In strict accordance with the installation instructions supplied by the Manufacturer.
2. In rotary hammer drilled holes, unless otherwise approved by Engineer.
3. In drilled out holes of the proper depth and diameter cleaned of dust and debris according to the Manufacturer’s specific installation instructions.

B. Provide sizes, spacings, edge distances and embedment as indicated on the Drawings.

C. Anchors that Resist Loads Through an Injectable Chemical Adhesive:
1. Install in concrete with minimum age of 21 days, and in masonry with a minimum age of 7 days.
2. Do not apply load until adhesive has properly cured and developed specified strength where cure time shall be as called out in the Manufacturer’s literature based on prevailing environmental conditions at the time of installation.

3.2 CLEANING

A. Clean materials installed under this Section according to Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 03 15 16

SECTION 03 30 03 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of formwork, reinforcement and concrete.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ACI - American Concrete Institute:
      a. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
      b. 301 - Specifications for Structural Concrete.
      c. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
      d. 305R - Hot Weather Concreting.
      e. 306R - Cold Weather Concreting.
      f. 309R - Guide for Consolidation of Concrete.
      g. 318 - Building Code Requirements for Structural Concrete.
      h. 347R - Guide to Formwork for Concrete.
   2. ASTM Standard Specifications, Test Methods, and Classifications:
      a. A185 – Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
      b. A615 - Specification for Deformed and Plain Billet - Steel Bars for Concrete Reinforcement.
      c. A1064 - Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
      d. C31 – Practice for Making and Curing Concrete Test Specimens in the Field.
      e. C33 - Specification for Concrete Aggregates.
      f. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      g. C94 - Specification for Ready-Mixed Concrete.
      h. C138 – Test Method for Density (Unit Weight), Yield and Air Content (Gravimetric) of Concrete.
      i. C143 – Test Method for Slump of Hydraulic-Cement Concrete.
      j. C150 - Specification for Portland Cement.
      k. C172 - Practice for Sampling Freshly Mixed Concrete.
      l. C173 - Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
      m. C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
      n. C260 - Specification for Air-Entraining Admixtures for Concrete.
      o. C309 - Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      p. C494 - Specification for Chemical Admixtures for Concrete.
      q. C595 – Blended Hydraulic Cement.
   3. MDOT Publications:
      a. Standard Specifications for Construction.
      b. Standard Plans.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Formwork: Perform the design and engineering of formwork, as well as its construction.

1.5 SUBMITTALS

A. Shop Drawings: For reinforcing steel.

B. Mix Designs: Submit for review prior to placing concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Formwork:
1. Form grade plywood or metal panels; no torn edges or worn plywood.
2. Form Release Agent: Non-staining, non-emulsifiable type.
3. Form ties, spreaders, and accessories as required by the formwork design.
4. Provide chamfered strips in exposed corners of concrete.

B. Reinforcement:
1. Reinforcing Bars:
   a. ASTM A615.
   b. Yield Stress: F_y = 60,000 psi, Grade 60.
2. Welded Wire Fabric:
   a. ASTM A185 or A1064.
   b. Yield Stress: F_y = 65,000 psi.
3. Accessories resting on surfaces to be left exposed as finished surfaces shall have plastic coated legs.

C. Concrete Materials:
1. Portland Cement: ASTM C150, Type I, or A595, Type 1L.
2. Ground-Granulated Blast Furnace (GGBF) Slag: ASTM C989, Grade 100 or 120.
3. Fine and Coarse Aggregates:
   a. Inert, non-chemically reactive, and non-radioactive.
   b. Conforming with ASTM C33.
4. Water: Clean, fresh, and potable.
5. Air-Entrainment:
   a. ASTM C260.
   b. For all concrete mixes except interior floor slabs and pads.
6. Water Reducing Agents: ASTM C494.
7. No calcium chloride allowed in materials used in concrete mix.
8. Membrane Curing Compounds: ASTM C309.

2.2 CONCRETE MIXES

A. Proportioning:
1. Proportions of materials for concrete shall be in accordance with ACI 211.1.
2. Mix Design 1: Interior Building Slab.
   a. Minimum Design Compressive Strength: 4,000 psi.
   b. Minimum Cementitious Content: 5.5 sacks.
   c. Replacement of Cement by Slag: Permitted, up to 35%.
   d. Water-Cementitious Ratio: 0.52 maximum.
   e. Slump Limits: 4 inches ± 1-inch before addition of water reducer, if any.
   f. Entrained Air Content: 0%.
3. Mix Design 2: Foundations.
   a. Minimum Design Compressive Strength: 4,000 psi.
   b. Minimum Cementitious Content: 5.5 sacks.
   c. Replacement of Cement by Slag: Permitted, up to 35%.
   d. Water-Cementitious Ratio: 0.45 maximum.
   e. Slump Limits: 4 inches ± 1-inch before addition of water reducer, if any.
   f. Entrained Air Content: 6% ± 1%.

2.3 SOURCE QUALITY CONTROL

A. Production and Delivery:
1. Batch, mix and transport ready mixed concrete in accordance with ASTM C94.
2. Furnish ready-mix delivery tickets with each batch of concrete before unloading at the Site, on which is printed, stamped or written the following information:
   a. Name of ready-mix batch plant.
   b. Serial number of ticket.

c. Date and truck number.
d. Name of Contractor.
e. Project name and location.
f. Specific class of designation of concrete.
g. Amount of concrete (cubic yards).
h. Time loaded or of first mixing of cement and aggregates.
i. Type, name and amount of admixture.

3. Minor amounts of concrete may be mixed on Site with prior review by Engineer.

PART 3 - EXECUTION

3.1 ERECTION AND PLACEMENT

A. Forms:
1. Provide required forms, shores, bracing, breast timbers, form ties and accessories in sufficient quantities so as not to delay the work.
2. Coordinate work with other trades for the installation of embedded items and form penetrations.
3. Form Removal: No earlier than 3 days.

B. Reinforcement:
1. Free from rust scale, loose mill scale, oil, paint, and other coatings which will destroy or reduce bond between steel and concrete at the time concrete is placed around it.

C. Concrete:
1. Handle concrete from mixer to place of final deposit in carts, buggies or conveyors.
2. Compact concrete by mechanical vibration equipment, but do not transport concrete through forms by vibrating.
3. Concrete Finish:
a. Formed Surfaces: As cast, smooth formed finish.
b. Unformed Exposed Surfaces:
1) Interior: Smooth troweled finish unless specified otherwise.
2) Exterior: Light broomed finish unless specified otherwise.
4. As soon as possible after finishing or removing forms, treat surfaces with a liquid membrane-forming curing compound unless specified otherwise.
5. Protect freshly placed concrete from damage due to extreme temperatures in accordance with ACI 305R and ACI 306R.

END OF SECTION 03 30 03

SECTION 04 20 00 - UNIT MASONRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete block.

B. Integrally colored concrete veneer block.

C. Mortar and grout.

D. Reinforcement and anchorage.

E. Flashings.

F. Lintels.

G. Accessories.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.3 SUBMITTALS

A. See Section 01 33 00 - Submittal Procedures.

B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.

C. Samples: Submit four samples of integrally colored concrete veneer block units to illustrate color, texture, and extremes of color range.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
   2. Special Shapes: Provide nonstandard blocks configured for corners, lintels, bond beams, headers, control joint edges, and other detailed conditions.
      a. Provide bullnose units for outside corners.

3. Load-Bearing Units: ASTM C90, medium weight.
   a. Both hollow and solid block, as indicated.
   b. Exposed Faces: Manufacturer's standard color and texture for interior block surfaces.
4. Nonloadbearing Units: ASTM C129.
   a. Hollow block, as indicated.

B. Integrally Colored Concrete Veneer Block:
1. Size: As indicated on drawings.
2. Concrete Veneer Block: ASTM C1634; cored, normal weight; for architectural use.
   a. Exposed Faces: Color and texture to match products listed on the drawing schedules.
3. Units with Integral Water Repellent: Concrete block units as specified in this section with polymeric liquid or powder admixture added to concrete masonry units at the time of manufacture.
   a. Performance of Units with Integral Water Repellent:
      1) Water Permeance: When tested per ASTM E514/E514M and for a minimum of 72 hours.
         a) No water visible on back of wall above flashing at the end of 24 hours.
         b) No flow of water from flashing equal to or greater than 0.032 gallons per hour at the end of 24 hours.
         c) No more than 25 percent of wall area above flashing visibly damp at end of test.
      2) Flexural Bond Strength: ASTM C1072; minimum 10 percent increase.
      3) Compressive Strength: ASTM C1314; maximum 5 percent decrease.
      4) Drying Shrinkage: ASTM C1148; maximum 5 percent increase in shrinkage.
   b. Use only in combination with mortar that also has integral water repellent admixture.
   c. Use water repellent admixtures for masonry units and mortar by a single manufacturer.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I; color as required to produce color of mortar on the Gun Lake Tribe Administration Building.
1. Not more than 0.60 percent alkali.

B. Hydrated Lime: ASTM C207, Type S.

C. Mortar Aggregate: ASTM C144.

D. Grout Aggregate: ASTM C404.

E. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
1. Color(s): To match the color of mortar on the Gun Lake Tribe Public Works Building when incorporated into specified mix design(s).

F. Water: Clean and potable.

G. Accelerating Admixture: Nonchloride type for use in cold weather.

H. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
1. Type: Type N.
2. Color: Standard gray for interior block surfaces to be painted.

I. Packaged Dry Material for Grout for Masonry: Premixed cementitious materials and dried aggregates; capable of producing grout of the specified strength in accordance with ASTM C476 with the addition of water only.
1. Type: Fine.

2.3 REINFORCEMENT AND ANCHORAGE

A. Manufacturers:
   1. Blok-Lok Limited: www.blok-lok.com/#sle.
   2. Hohmann & Barnard, Inc: www.h-b.com/#sle.
   3. WIRE-BOND: www.wirebond.com/#sle.

B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars.

C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

D. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Ladder, with adjustable ties or tabs spaced at 16 in on center.
   2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M Class B.
   3. Size: 0.1875 inch side rods with 0.1483 inch cross rods and adjustable components of 0.1875 inch wire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.
   4. Vertical adjustment: Not more than 1 1/4 inches.
   5. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

2.4 FLASHINGS

A. Metal Flashing Materials:
   1. Stainless Steel Flashing: ASTM A666, Type 304, soft temper; 26 gauge, 0.0187 inch thick; finish 2B to 2D.

B. Combination Non-Asphaltic Flashing Materials - Stainless Steel:
   1. Stainless Steel Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet with 8 mil of butyl adhesive and a removable release liner.
   2. Stainless Steel/Polymer Fabric Flashing - Self-adhering: ASTM A240/A240M; 2 mil type 304 stainless steel sheet bonded on inward facing side to a sheet of polymer fabric that has a clear adhesive with a removable release liner.

C. Factory-Fabricated Flashing Corners and End Dams: Stainless steel.

D. Flashing Sealant/Adhesives: Silicone, polyurethane, or silyl-terminated polyether/polyurethane or other type required or recommended by flashing manufacturer; type capable of adhering to type of flashing used.

E. Termination Bars: Stainless steel; compatible with membrane and adhesives.

F. Drip Edge: Stainless steel; flat drip with hemmed edge; compatible with membrane and adhesives.

G. Lap Sealants and Tapes: As recommended by flashing manufacturer; compatible with membrane and adhesives.

2.5 ACCESSORIES

A. Building Paper: ASTM D226/D226M, Type I (No. 15) asphalt felt.

B. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self-expanding; in maximum lengths available.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.
   1. Mortar Diverter: Semi-rigid mesh designed for installation at flashing locations.

D. Weeps:
   1. Type: Molded PVC grilles, insect resistant.
   2. Color(s): As scheduled on the drawings.

E. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6 MORTAR AND GROUT MIXING

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.
   1. Masonry below grade and in contact with earth: Type S.
   2. Exterior, loadbearing masonry: Type N.

B. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio.

C. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

D. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

E. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2 PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3 COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of TMS 402/602 or applicable building code, whichever is more stringent.

3.4 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

D. Veneer Block Units:
   1. Bond: Running.
   2. Coursing: One unit and mortar joint to equal 8 inches.
   3. Mortar Joints: Concave.

3.5 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Interlock intersections and external corners.

F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

3.6 WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 32 inches on center horizontally on top of through-wall flashing above shelf angles and lintels and at bottom of walls.

3.7 CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. For cavity walls, build inner wythe ahead of outer wythe to accommodate accessories.

C. Install cavity mortar diverter at base of cavity and at other flashing locations as recommended by manufacturer to prevent mortar droppings from blocking weep/cavity vents.

3.8 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY

A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.

E. Lap joint reinforcement ends minimum 6 inches.

F. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

3.9 REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Masonry Back-Up: Embed anchors to bond veneer at maximum 16 inches on center vertically and 32 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.10 MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.
   1. Extend flashings full width at such interruptions and at least 6 inches, minimum, into adjacent masonry or turn up flashing ends at least 1 inch, minimum, to form watertight pan at nonmasonry construction.
   2. Remove or cover protrusions or sharp edges that could puncture flashings.
   3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Terminate flashing up 8 inches minimum on vertical surface of backing:
   1. Install vertical leg of flashing over fluid-applied or self-adhered air/vapor barriers over backing or per manufacturer’s directions.
   2. Anchor vertical leg of flashing into backing with a termination bar and sealant.
   3. Apply cap bead of sealant on top edge of self-adhered flashing.

C. Install flashing in accordance with manufacturer's instructions and BIA Technical Notes No. 7.

D. Support flexible flashings across gaps and openings.

E. Lap end joints of flashings at least 6 inches, minimum, and seal watertight with flashing sealant/adhesive.

3.11 LINTELS

A. Install loose steel lintels over openings.

B. Install reinforced unit masonry lintels over openings where steel or precast concrete lintels are not scheduled.

3.12 GROUTED COMPONENTS

A. Lap splices minimum 24 bar diameters.

B. Support and secure reinforcing bars from displacement. Maintain position within 1/2 inch of dimensioned position.

C. Place and consolidate grout fill without displacing reinforcing.

3.13 CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Form control joint with a sheet building paper bond breaker fitted to one side of the hollow contour end of the block unit. Fill the resultant core with grout fill. Rake joint at exposed unit faces for placement of backer rod and sealant.

3.14 BUILT-IN WORK

A. As work progresses, install built-in metal door frames, glazed frames, window frames, and anchor bolts and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

3.15 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

3.16 CUTTING AND FITTING

A. Cut and fit for chases, pipes, conduit, and sleeves. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.17 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests.

3.18 CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

D. Use non-metallic tools in cleaning operations.

3.19 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION 04 20 00

SECTION 05 50 00 – METAL FABRICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing, fabrication and erection of metal fabrications, including the major items listed below:
   1. Loose angle and wide flange lintels.
   2. Bearing plates for other items specified herein.
   3. Galvanizing of selected items.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the pertinent provisions of the following:
   1. ASTM Standard Specifications:
      a. A36 - Structural Steel.
      b. A47 - Ferritic Malleable Iron Castings.
      c. A48 - Gray Iron Castings.
      d. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
      e. A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
      f. A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
      g. A276 - Stainless Steel Bars and Shapes.
      h. A307 - Carbon Steel Bolts and Studs, 60,000 psi, Tensile Strength.
      i. A325 - Structural Bolts, Heat-Treated, 120/105 ksi Minimum Tensile Strength.
      j. A366 - Commercial Steel (CS) Sheet, Carbon (0.15 Maximum Percent), Cold-Rolled.
      k. A490 - Heat Treated Steel Structural Bolts, 150 ksi Minimum Tensile Strength.
      l. A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
      m. A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
      n. A563 - Carbon and Alloy Steel Nuts.
      o. A780 - Standard Practice for Repair of Damaged Hot-Dip Galvanized Coatings.
      p. A786 - Rolled Steel Floor Plates.
      q. A992 - Steel for Structural Shapes for Use in Building Framing.
      r. B209 - Aluminum and Aluminum Alloy Sheet and Plate.
      s. B221 - Aluminum Alloy Extruded Bars, Rods, Wire, Profiles, & Tubes.
      t. B633 - Electro-deposited Coatings of Zinc on Iron and Steel.
      u. D520 - Zinc Dust Pigment for Paint.
      v. E488 - Strength of Anchors in Concrete and Masonry Elements.
      w. E1512 - Testing Bond Performance of Adhesive-Bonded Anchors.
      x. F436 - Hardened Steel Washers.
      y. F593 - Stainless Steel Bolts, Hex Cap Screws, and Studs.
      z. F594 - Stainless Steel Nuts.
      aa. F1267 - Expanded Metal, Steel.
      bb. F1554 - Anchor Bolts, Steel, 36, 55, and 105 ksi Yield Strength.
   2. AISC publications:
      a. Code of Standard Practice for Steel Buildings and Bridges (excluding Section 4.2.1).
      b. Specification for the Design, Fabrication and Erection of Structural Steel for Buildings.
      c. Detailing for Steel Construction.
      d. Manual of Steel Construction.
      e. Specification for Structural Joints Using ASTM A325 or A490 Bolts.
   3. AWS publications:
      a. ANSI/AWS A5.1 - Carbon Steel Electrodes for Shielded Arc Welding.

b. ANSI/AWS A5.3 - Aluminum and Aluminum Alloy Electrodes for Shielded Arc Welding.
c. ANSI/AWS A5.4 - Stainless Steel Electrodes for Shielded Arc Welding.
d. ANSI/AWS D1.1 - Structural Welding Code - Steel.
e. ANSI/AWS D1.2 - Structural Welding Code - Aluminum.
f. ANSI/AWS D1.6 - Structural Welding Code - Stainless Steel.

4. ASME - American Society of Mechanical Engineers:
   a. ANSI/ASME B18.2.1 - Heavy Hex Structural and Askew Head Bolts.
   b. ANSI/ASME B18.6.1 - Wood Screws.
   c. ANSI/ASME B18.6.3 - Slotted and Recessed Head Machine Screws.
   d. ANSI/ASME B18.21.1 - Lock Washers.
   e. ANSI/ASME B18.22.1 - Plain Washers.
5. Federal Specifications:
   a. FS FF-B-588C(1) - Bolt, Toggle, and Expansion Sleeve, Screw.
6. American Hot-Dip Galvanizers Association.
7. Occupational Safety and Health Act.
8. NAAMM - National Association of Architectural Metal Manufacturers.
9. The Aluminum Association.

1.4 SUBMITTALS

A. Shop Drawings: For all members to be furnished to include:
   1. Detail Drawings of Members and Connections:
      a. In accordance with AISC - Detailing for Steel Construction.
      b. Size and number of bolts.
      c. Dimensions.
      d. Connection angles and plates.
   2. Erection Drawings: Locate and identify members.
   3. Welding: In accordance with AWS welding symbols.
   4. Type of paint.
   5. Item to be galvanized.

1.5 QUALITY ASSURANCE

A. Fabrication and Erection Personnel Qualifications:
   1. Trained and experienced in the type of work being performed.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Welders, Welding Operators and Tackers Qualifications:
   1. Qualified by tests in accordance with AWS D1.1.
   2. Qualification Papers:
      a. Given by an independent testing laboratory.
      b. Dated no earlier than 6 months prior to beginning of Project.
   3. Engineer, at Engineer's discretion, may accept evidence of previous qualifications.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or distorted material and immediately remove from the Site. Replace rejected materials with new material at no additional cost to Owner.

D. Embedded Items:
   1. Includes anchor rods and other anchorage devices which are to be embedded in cast-in-place concrete or masonry.
   2. Delivered on the Project Site in time to be installed before the start of cast-in-place concrete or masonry operations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Materials shall be new, top quality of their respective kinds, standard sizes and fabricated in a shop whose principal business is manufacturing the items specified in this Section.

B. Steel:
   1. M, S, MT and ST Shapes, Channels, Angles, Bars, Plates and Rods: ASTM A36 with yield stress of 36,000 psi.

C. Paint: In accordance with Division 09 Section “Painting.”

2.2 METAL FABRICATIONS

A. Fasteners:
   1. Bolts:
      a. Use carbon or alloy steel, ASTM A325 3/4-inch diameter bolts or larger as required by connection design.
      b. Use ASTM A490 3/4-inch diameter bolts or larger only if required by connection design.
      c. If conditions require that galvanized materials be used, use ASTM A307 or A325 bolts. Do not galvanize A490 bolts, as that could possibly cause hydrogen embrittlement, and will affect hardness.
   2. Nuts:
      a. Carbon Steel: ASTM A563.
   3. Washers:
      a. Hardened Steel Washers: ASTM F436.
      b. Plain Washers: ASME B18.22.1, round, carbon steel.
      c. Lock Washers: ASME B18.21.1, helical, spring type, carbon steel.
   4. Lag Bolts: ASME B18.2.1, square or hex head type.
   5. Toggle Bolts: Tumble wing type in accordance with FS FF-B-588.
   6. Machine Screws: ASME B18.6.3.
   7. Wood Screws: ASME B18.6.1.

B. Anchors: In accordance with Division 03 Section “Post-Installed Anchors”.

C. Other Materials: Other materials not specifically described but required for a complete and proper installation of the work of this Section, shall be new, first quality of their respective kinds, and as selected by Contractor subject to approval of Engineer.

2.3 FABRICATION

A. General:
   1. Workmanship: Install items square and level, accurately fitted and free from distortion and defects.
   2. Temporary Bracing:
      a. Make provision for erection stresses by temporary bracing.
      b. Keep work in alignment.
   3. Welding:
      a. Steel welding shall be performed in accordance with AISC Specification and AWS D1.1.
      b. Filler metal requirements for steel welding processes shall be in accordance with AWS D1.1 and AWS A5.1.
      c. Aluminum welding shall be performed in accordance with AWS D1.2.
      d. Filler metal requirements for aluminum welding processes shall be in accordance with AWS A5.3.
      e. Stainless steel welding shall be performed in accordance with AWS D1.6.
      f. Filler metal requirements for stainless steel welding processes shall be in accordance with AWS A5.4.
      g. Welding shall be continuous along entire area of contact.
   4. Painting: Prime paint metal fabrications in accordance with Division 09 Section “Painting.”

5. Items fabricated from structural steel members which are to be architecturally exposed shall be given special attention for material selection with respect to rolling tolerances, surface finish and straightness.
6. Normal structural steel fabrication tolerances will not be acceptable where in conflict with the intent and requirements of this Section.
7. Curved beam sections shall be fabricated without distortion to top and bottom flange width and thickness.
8. Straightness tolerances, additive to deflection, shall not exceed ± 1/16-inch to 10 feet.
9. Cope, miter, and butt caps on exposed surfaces shall be made to the closest possible tolerances consistent with metal shop equipment and practice in order to provide a pleasing appearance.
10. Fastening shall be concealed where practicable. Thickness or metal and details of assembly and supports shall give ample strength and stiffness. Joints exposed to weather shall be formed to exclude water. Provide holes and connections for the work of other trades.

B. Galvanizing:
   1. Hot-dipped galvanized after fabrication in accordance with ASTM A123.
   2. 2 oz/ sq ft minimum.
   3. Galvanize the following items:
      a. Bolts, nuts and washers for connections.
      b. Items so indicated on the Drawings.

C. Galvanized Fasteners:
   1. Hot-dipped galvanized after fabrication in accordance with ASTM A153.
   2. Class C (1.25 oz/sq ft) minimum coating.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Workmanship: Install items square and level, accurately fitted and free from distortion and defects.

B. Erection:
   1. Bracing:
      a. Provide all shoring, bracing and accessories required for complete erection.
      b. Safety and adequacy of bracing and temporary bracing are the responsibility of the Contractor.

C. Coordination: Supply to appropriate trades items to be cast into concrete or embedded in masonry, complete with necessary setting templates.

D. Tightening:
   1. Tighten bolts snug-tight as defined by AISC, unless otherwise noted on the Drawings.
   2. Tighten bolts in slotted holes using the AISC Turn-of-the-Nut Method, unless indicated otherwise on the Drawings.
   3. Where specifically indicated on the Drawings, finger-tighten nuts in connections where movement must be permitted, and tighten a jam nut over finger-tightened nut, or peen bolt threads, to prevent nut backoff.

E. Touch-up:
   1. After erection is complete, touch up all shop priming coats damaged during transportation and erection.
   2. Prime all field welds, bolt heads, nuts and abrasions using the priming paint specified for shop priming.
   3. Touch up all damaged galvanized areas with a zinc rich paint meeting ASTM D520 and ASTM A780.

F. Welding: Field welding shall be performed to the same standards and requirements of shop welding.

G. Protection: Where required, provide approved protection against galvanic action between contacts of dissimilar metal or situations that will cause deterioration of metal in contact or associated in any way.

3.2 CLEANING

A. Prior to acceptance of the work of this Section, thoroughly clean all installed materials and related areas in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 05 50 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fascia boards.
   2. Roof framing.
   3. Roof Sheathing.
   4. Preservative treated wood materials.
   5. Miscellaneous wood blocking where indicated.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2016.

D. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.

E. PS 1 - Structural Plywood; 2009.

F. PS 20 - American Softwood Lumber Standard; 2015.

1.3 SUBMITTALS

A. See Division 01 Section Submittal Procedures.

1.4 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.5 WARRANTY

A. See Division 01 for additional warranty requirements.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
   2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSION LUMBER

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: Kiln-dry or MC15.

C. Rafter Framing:
1. Species: Allowed under grading rules.
2. Grade: No. 1 and Better.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.3 CONSTRUCTION PANELS

A. Roof Sheathing: Plywood; PS 2.
1. Bond Classification: Exterior.
2. Performance Category: 3/4 inch PERF CAT.
3. Edges: Square.

2.4 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
1. For contact with preservative treated wood in exposed locations, provide minimum G185 (Z550) galvanizing complying with ASTM A653/A653M.

2.5 FACTORY WOOD TREATMENT

A. Preservative Treatment:
1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
b. Treat lumber in contact with roofing, flashing, or waterproofing.
c. Treat lumber in contact with masonry or concrete.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.2 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.3 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.4 SITE APPLIED WOOD TREATMENT

A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts, complying with manufacturer's instructions.

B. Allow preservative to dry prior to erecting members.

3.5 CLEANING

A. Waste Disposal: Comply with the requirements of Division 01.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION 06 10 00

SECTION 06 64 00 - PLASTIC PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes plastic sheet paneling.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
   1. Basis of Design: FRP by Formglas Products, Ltd.; 566 635-8030.
   2. Subject to compliance with requirements, provide products by one of the following.
      a) Panolam FRP by Panolam Industries International, Inc.
      b) Crane Composites FRP Wall Panels
      c) Marllite
      d) Nudo Products, Inc.
   2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
      1. Flame-Spread Index: 200 or less.
      2. Smoke-Developed Index: 450 or less.
   3. Nominal Thickness: Not less than 3/16 inch.
   4. Surface Finish: Molded pebble texture.
   5. Color: White.

2.3 ACCESSORIES

A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as needed to conceal edges.
   1. Color: White.

B. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.

C. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.

D. Sealant: Mildew-resistant, single-component, neutral-curing or acid-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Division 07 Section “Joint Sealants.”

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

B. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

C. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.

D. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels so that trimmed panels at corners are not less than 12 inches wide.
1. Mark plumb lines on substrate at panel joint locations for accurate installation.
2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

A. Install plastic paneling according to manufacturer's written instructions.

B. Install panels in a full spread of adhesive.

C. Install panels with fasteners. Layout fastener locations and mark on face of panels so that fasteners are accurately aligned.
1. Drill oversized fastener holes in panels and center fasteners in holes.
2. Apply sealant to fastener holes before installing fasteners.

D. Install trim accessories with adhesive. Do not fasten through panels.

E. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

F. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 06 64 00

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes bituminous dampproofing.

1.3 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2016).

B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2011).

C. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013.

1.4 SUBMITTALS

A. See Division 01 Section “Submittal Procedures.”

B. Product Data: Provide properties of primer, bitumen, and mastics.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with at least 3 years of documented experience.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures above 40 degrees F (5 degrees C) for 24 hours before and during application until dampproofing has cured.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Bituminous Dampproofing Manufacturers:
   1. BASF Construction Chemicals - Building Systems; Sonneborn Brand Products.
   2. Henry Company.
   3. Karnak Corporation.
   4. Koppers Inc.
   5. W. R. Meadows, Inc.
   6. Substitutions: See Division 01 Section “Product Substitution Procedures.”

2.2 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Composition - Vertical Application: ASTM D1227 Type III or ASTM D1187/D1187M Type I.
   2. VOC Content: Not more than permitted by local, State, and federal regulations.
   3. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.3 BITUMEN MATERIALS

A. Cold Asphaltic Type:
   1. Bitumen: Emulsified asphalt, ASTM D1227; with fiber reinforcement other than asbestos (Type II).
   2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

A. Perform this work in accordance with manufacturer's instructions.

B. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

C. Apply bitumen by spray application.

D. Seal items watertight with mastic, that project through dampproofing surface.

END OF SECTION 07 11 13

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the following:
   1. Perimeter wall insulation (supporting backfill).
   2. Cavity-wall insulation.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

B. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.
   1. Surface-Burning Characteristics: ASTM E 84.
   2. Fire-Resistance Ratings: ASTM E 119.
   3. Combustion Characteristics: ASTM E 136.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect 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 plastic insulating materials to Project site before installation time.
   3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FOAM-PLASTIC BOARD INSULATION

A. Extruded-Polystyrene Board Insulation: ASTM C 578, of type and density indicated below, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively:
   1. Manufacturers:
      a. DiversiFoam Products.
      b. Dow Chemical Company.
      c. Owens Corning.
   2. Type IV, 1.60 lb/cu. ft., unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer. At locations where there are occupied spaces below grade, extend insulation from the grade line to the footing. At edge of slab on grade, extend insulation a minimum of 24 inches below the exterior grade line.

3.5 INSTALLATION OF CAVITY-WALL INSULATION

A. On units of foam-plastic board insulation, install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face, and as recommended by manufacturer. Fit courses of insulation between wall ties and other obstructions, with edges butted tightly in both directions. Press units firmly against inside substrates indicated. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Division 04 Section "Unit Masonry."

3.6 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Closed-cell spray polyurethane foam insulation.
   2. Accessories including thermal barrier and ignition barrier coatings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:
   1. Product Data: For paints and coatings, indicating VOC content.
   2. Evaluation Reports or Certificates: For paints and coatings, indicating compliance with requirements for low-emitting materials.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Product Test Reports: For each product, for tests performed by qualified testing agency.
   2. Research Reports:
      a. For spray-applied polyurethane foam-plastic insulation, from ICC-ES.
      b. For fire-protective coatings applied to spray-applied polyurethane foam-plastic insulation, from an agency acceptable to the authority having jurisdiction.

B. Field Quality-Control Submittals:
   1. Field quality-control reports for foamed-in-place insulation.

C. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained on applications of spray-applied polyurethane foam-plastic insulation and intumescent coatings, or similar product types and approved by manufacturer.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION

A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. (24 kg/cu. m) and minimum aged R-value at 1-inch (25.4-mm) thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F (43 K x sq. m/W at 24 deg C).
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. AMBIT Polyurethane
      b. BASF Corporation.
      c. Carlisle Spray Foam Insulation.
      d. Creative Polymer Solutions.
      e. Elastochem.
      f. Demilec; a brand of Huntsman Building Products.
      g. Gaco; a brand of Enverge.
      h. Green Valley Products.
      i. Icynene; a brand of Huntsman Building Products.
      j. Johns Manville.
      k. Lapolla; a brand of Huntsman Building Products.

l. Natural Polymers.
m. NCFI.
n. Premium Icynene; a brand of Huntsman Building Products.
o. SES; a brand of Enverge.
p. SWD Urethane Company.
q. UPC.

2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
   a. Flame-Spread Index: 25 or less.
   b. Smoke-Developed Index: 450 or less.

2.2 ACCESSORIES

A. Thermal Barrier Coating: Fire-protective intumescent coating formulated for application over polyurethane foam plastics, compatible with insulation, and passes NFPA 286, FM 4880, UL 1040, or UL 1715 testing as part of an approved assembly.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide No-Burn, Inc.; ThB Spray Seal intumescent coating:
   2. Performance Criteria:
      a. Finish: Flat.
      b. Color: Gray.
      c. VOC Content: 18 g/L or less of water in accordance with EPA 24.
      d. Solids by Volume: 70 percent.
   3. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.
   4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
   5. Topcoat: As recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.
      a. Protective Topcoat, Interior: 6- to 8-mil (0.15- to 0.20-mm) thick, exterior topcoat, VOC compliant, for interior unconditioned spaces subject to constant high humidity, condensation, or direct contact with moisture.

B. Ignition Barrier Coating: Fire-protective coating formulated for application over polyurethane foam plastics, compatible with insulation, and in compliance with ICC-ES AC377, Appendix X.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide No-Burn, Inc.; ThB Spray Seal intumescent coating.
   2. Performance Criteria:
      a. Finish: Flat.
      b. Color: Gray.
      c. VOC Content: 18 g/L or less of water in accordance with EPA 24.
      d. Solids by Volume: 60 to 70 percent.
   3. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
      a. Flame-Spread Index: 25 or less.
      b. Smoke-Developed Index: 50 or less.
   4. Topcoat: As recommended in writing by intumescent thermal barrier manufacturer as compatible with substrate materials.
      a. Protective Topcoat, Interior: 6- to 8-mil (0.15- to 0.20-mm) thick, heavy-duty protective topcoat, VOC compliant, for interior unconditioned spaces subject to constant high humidity, condensation, or direct contact with moisture.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with manufacturer's requirements for surface treatments, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with coating application only after unsatisfactory conditions have been corrected and surfaces are dry.

3.2 PREPARATION

A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.

3.3 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Spray insulation to envelop entire area to be insulated and fill voids.

C. Do not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

D. Framed Construction: Install into cavities formed by framing members to achieve thickness indicated on Drawings.

E. Miscellaneous Voids: Apply in accordance with manufacturer's written instructions.

F. Apply fire-protective intumescent coatings in accordance with manufacturer's written instructions and to comply with requirements for listing and labeling for fire-propagation characteristics and surface-burning characteristics specified.
   1. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
   2. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
   3. Apply coatings to produce surface films without holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

3.4 FIELD QUALITY CONTROL

A. Continuously monitor wet film thickness (WFT) by performing periodic checks to ensure correct thicknesses are applied.
   1. Measuring Thickness:
      a. Install medallions prior to applying intumescent thermal barrier coating to measure wet film thickness and dry film thickness.
      b. Perform thickness measurements by measuring representative sample of installed intumescent coating material by means of calipers, optical comparators, or similar devices.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 07 21 19

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vapor Retarders: Materials to make exterior walls water vapor resistant and air-tight.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls and joints around frames of openings in exterior walls.

1.2 DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.
   1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

D. Water-Resistive Barrier: Water-shedding barrier made of material that is moisture resistant, to the degree specified, intended to be installed to shed water without sealed seams.

1.3 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2019.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2020.

C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials 2016.

D. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials 2013.

E. ICC-ES AC148 - Acceptance Criteria for Flexible Flashing Materials 2017.

F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components 2019.

1.4 SUBMITTALS

A. Product Data: Provide data on material characteristics.

B. Manufacturer's Installation Instructions: Indicate preparation.

1.5 FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.1 AIR BARRIER MATERIALS (AIR AND VAPOR BARRIER)

A. Air and Vapor Barrier Sheet, Fluid-Applied:
1. Property Type: Synthetic acrylic.
2. Air Permeance: 0.004 cfm/sq ft, maximum, when tested in accordance with ASTM E2178.
3. Water Vapor Permeance: .004 perm, maximum, when tested in accordance with ASTM E96/E96M Procedure A (Desiccant Method) at 73.4 degrees F.
4. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M.
5. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 60 days of weather exposure.
6. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
7. Seam and Perimeter Tape: As recommended by sheet manufacturer.
8. Basis of Design:
   a. Carlisle Coatings and Waterproofing, Inc; Fire Resist Barritech NP: www.carlisleccw.com/#sle.
   b. Subject to compliance with requirements, equivalent products of the following manufacturers will be acceptable:
      1) GCP Applied Technologies; www.gcpat.com/#sle.
      2) Tremco Commercial Sealants & Waterproofing; www.tremcosealants.com/#sle.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Flexible Flashing: Sheathing fabric saturated with vapor retarder coating and complying with the applicable requirements of ICC-ES AC148.

C. Pre-formed Transition Membrane: Semi-rigid silicone or polyester composition, tapered edges, and tear resistant.

D. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.

E. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive sealants in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Prepare substrate in accordance with manufacturer's installation instructions; treat joints in substrate and between dissimilar materials as indicated.

C. Where exterior masonry veneer is being installed, install masonry anchors before installing weather barrier over masonry; provide airtight seal around anchors.

D. Apply bead or trowel coat of mastic sealant with minimum thickness of 1/4 inch along coating seams, rough cuts, and as recommended by manufacturer.

E. Use flashing to seal to adjacent construction and to bridge joints in coating substrate.

3.4 FIELD QUALITY CONTROL

A. Do not cover installed weather barriers until required inspections have been completed.

B. Obtain approval of installation procedures by the weather barrier manufacturer based on a mock-up installed in place, prior to proceeding with remainder of installation.

C. Take digital photographs of each portion of the installation prior to covering up.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION 07 25 00

SECTION 07 41 13 - METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Architectural roofing system of preformed aluminum panels.

B. Attachment system.

C. Finishes.

D. Gutters and downspouts.

E. Accessories.

1.2 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Storage and handling requirements and recommendations.
   2. Installation methods.
   3. Specimen warranty.

B. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Submit calculations documenting sizing of gutters and downspouts based on criteria indicated on the drawings and in paragraph 2.7.C of this specification.

C. Selection Samples: For each roofing system specified, submit color chips representing manufacturer's full range of available colors and patterns.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches square, representing actual roofing metal, thickness, profile, color, and texture.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Provide strippable plastic protection on prefinished roofing panels for removal after installation.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.5 COORDINATION

A. Coordinate location of roof penetrations with other disciplines to assure that penetrations do not occur at rib locations. Where size of penetration makes disruption of panel ribs unavoidable, provide factory-fabricated flashings at metal panel ribs, roof penetrations and equipment curbs in accordance with roof panel manufacturer requirements for warranty of the assembly.

B. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits and other adjoining work to provide a leakproof, secure and noncorrosive installation.

1.6 WARRANTY

A. Finish Warranty: Provide manufacturer's special warranty covering failure of factory-applied exterior finish on metal roof panels and agreeing to repair or replace panels that show evidence of finish degradation, including significant fading, chalking, cracking, or peeling within specified warranty period of twenty years from Date of Substantial Completion.

B. Waterproofing Warranty: Provide manufacturer's warranty for weathertightness of roofing system, including agreement to repair or replace roofing that fails to keep out water within specified warranty period of five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design:
   1. Metal Roof Panels: 1-1/2 inch Field-Lok manufactured by ATAS International, Inc.

B. Other Acceptable Manufacturers; Metal Roof Panels:
   1. Berridge Manufacturing Company: www.berridge.com/#sle.
   2. Fabral: www.fabral.com/#sle.
   3. Firestone Building Products LLC: www.firestonebpco.com/#sle.
   4. Metl-Span, a Division of NCI Group, Inc: www.metlspan.com/#sle.
   5. Morin Corporation: www.morincorp.com/#sle.
   6. Petersen Aluminum Corporation: www.pac-clad.com/#sle.

2.2 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Air Infiltration: Maximum 0.06 cfm/sq ft at air pressure differential of 6.24 lbf/sq ft, when tested according to ASTM E1680.
   4. Water Penetration: No water penetration when tested according to procedures and recommended test pressures of ASTM E1646. Perform test immediately following air infiltration test.
   5. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F.

2.3 ARCHITECTURAL METAL ROOF PANELS

A. Architectural Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Architectural Metal Panels: Factory-formed panels with factory-applied finish.
   1. Aluminum Panels:
      a. Alloy and Temper: Aluminum complying with ASTM B209 (ASTM B209M); temper as required for forming.
      b. Thickness: Minimum 20 gauge, 0.032 inch.
   2. Profile: Standing seam, with minimum 1.5 inch seam height; concealed fastener system lapped seam in standing seam profile.
   3. Texture: Smooth.
   4. Length: Maximum possible length to minimize lapped joints. Where lapped joints are unavoidable, space laps so that each sheet spans over three or more supports.
   5. Width: Maximum panel coverage of 16 inches.

2.4 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.5 FABRICATION

A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

B. Joints: Provide captive gaskets, sealants, or separator strips at panel joints to ensure weathertight seals, eliminate metal-to-metal contact, and minimize noise from panel movements.

2.6 FINISHES

A. Fluoropolymer Coating System: Manufacturer's standard multi-coat thermocured coating system, including minimum 70 percent fluoropolymer color topcoat with minimum total dry film thickness of 0.9 mil, minimum; color and gloss as selected from manufacturer’s standards.

B. Color: As scheduled on the drawings.

2.7 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) rectangular profile.

B. Downspouts: Rectangular profile.

C. Gutters and Downspouts: Size for rainfall intensity determined by a storm occurrence of 1 in 10 years in accordance with SMACNA (ASMM) requirements.

D. Accessories: Continuous, removable leaf screen with sheet metal frame and hardware cloth screen. Profiled to suit gutters and downspouts.

E. Downspout Boots: Plastic.

F. Seal metal joints.

2.8 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, flashing at penetrations, and similar sheet metal items of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of aluminum and closed celll foam matching panel base metal and finish.

C. Sealants:
1. Exposed Sealant: Elastomeric, type recommended by metal roof panel manufacturer.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.
3. Seam Sealant: Factory-applied, non-skinning, non-drying type.

D. Underlayment: Synthetic non-asphaltic sheet, intended by manufacturer for mechanically fastened roofing underlayment without sealed seams.
1. Type: Woven polypropylene with anti-slip polyolefin coating on both sides.
2. Minimum Requirements: Comply with requirements of ICC-ES AC207 for non-self-adhesive sheet.
3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
4. Flammability: Minimum of Class A, when tested in accordance with ASTM E108.
5. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
6. Water Vapor Permeance: Vapor retarder; maximum of 1 perm, when tested in accordance with ASTM E96/E96M Procedure A (desiccant method).
7. Performance: Meet or exceed requirements for ASTM D226/D226M, Type II asphalt-saturated organic felt.
8. Liquid Water Transmission: Passes ASTM D4869/D4869M.
9. Functional Temperature Range: Minus 70 degrees F to 212 degrees F.
10. Fasteners: As specified by manufacturer and building code qualification report or approval.

E. Underlayment: Self-adhering rubber-modified asphalt sheet complying with ASTM D1970/D1970M; with strippable release film and woven polyolefin top surface.
1. Minimum Requirements: Comply with requirements of ICC-ES AC188 for non-self-adhesive sheet.
2. Sheet Thickness: 22 mil, 0.022 inch minimum total thickness.
3. Self Sealability: Passing nail sealability test specified in ASTM D1970/D1970M.
4. Service Temperature: -40 degrees F to 260 degrees F.
5. Low Temperature Flexibility: Passing test specified in ASTM D1970/D1970M.
6. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method (Method A).
7. Products:
a. Henry Company; Blueskin PE200HT: www.henry.com/#sle.
b. Polyglass USA, Inc; Polystick MTS Self-Adhered High Temperature Roof Underlayment: www.polyglass.us/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Broom clean wood sheathing prior to installation of roofing system.

B. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to assure that the completed roof will be free of leaks.

C. Remove protective film from surface of roof panels immediately prior to installation. Strip film carefully, to avoid damage to prefinished surfaces.

D. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by roof panel manufacturer.

E. Where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and panel manufacturer's instructions and recommendations, as applicable to specific project conditions. Anchor all components of roofing system securely in place while allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is absolutely required, use methods that will not distort panel profiles. Use of torches for field cutting is absolutely prohibited.

B. Accessories: Install all components required for a complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, caps, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install panels in strict accordance with manufacturer's instructions, minimizing transverse joints except at junction with penetrations.
   1. Form weathertight standing seams incorporating concealed clips, using an automatic mechanical seaming device approved by the panel manufacturer.
   2. Incorporate concealed clips at panel joints.
   3. Provide sealant tape or other approved joint sealer at lapped panel joints.
   4. Install sealant or sealant tape, as recommended by panel manufacturer, at end laps and side joints.

D. Gutters and Downspouts:
   1. Secure gutters and downspouts in place with fasteners.
   2. Slope gutters 1/4 inch per 10 feet (2.1 mm per m), minimum.
   3. Connect downspouts to downspout boots, and grout connection watertight.

3.4 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

END OF SECTION 07 41 13

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.

B. Sealants for joints within sheet metal fabrications.

1.2 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2017a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2019a.

D. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

E. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

F. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

G. ASTM D2178/D2178M - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2015a.

H. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2018).

I. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

J. CDA A4050 - Copper in Architecture - Handbook; current edition.

K. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.4 SUBMITTALS

A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

B. Samples for Initial Selection: For each type of sheet metal and accessory indicated with factory applied finishes.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. At Contractor's option, sheet metal materials may be fabricated from either Pre-Finished Galvanized Steel or Pre-Finished Aluminum.

B. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, 0.0239 inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As scheduled on the Drawings.

C. Pre-Finished Aluminum: ASTM B209 (ASTM B209M); 0.032 inch (0.81 mm) thick; plain finish shop pre-coated with fluoropolymer coating.
1. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
2. Color: As scheduled on the Drawings.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.4 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.5 ACCESSORIES

A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.

B. Underlayment: ASTM D2178/D2178M, glass fiber roofing felt.

C. Slip Sheet: Rosin sized building paper.

D. Primer: Zinc chromate type.

E. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.

F. Concealed Sealants: Non-curing butyl sealant.

G. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

H. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify pipes, sleeves, through wallsare solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

3.3 INSTALLATION

A. Secure flashings in place using concealed fasteners.

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

END OF SECTION 07 62 00

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof hatch at well houses. Manual operation.

1.2 SUBMITTALS

A. See Section 01 33 00 for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

D. Warranty Documentation:
   1. Submit manufacturer warranty.
   2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.4 WARRANTY

A. See Division 01 for Closeout Procedures for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Roof Hatch Manufacturers:
   1. Babcock-Davis: www.babcockdavis.com/#sle.
   2. Bilco Company: www.bilco.com/#sle.
   3. Dur-Red Products: www.dur-red.com/#sle.
   4. Milcor, Inc: www.milcorinc.com/#sle.
   5. Nystrom, Inc: www.nystrom.com/#sle.

2.2 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.
   1. Shop Primer: Manufacturer's or fabricator's standard, fast-curing, lead- and chromate-free, universal primer; selected for resistance to normal atmospheric corrosion, for compatibility with substrate and field-applied finish paint system indicated, and for capability to provide a sound foundation for field-applied topcoats under prolonged exposure.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D 1187.

D. Underlayment:
   1. Felt: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
   2. Polyethylene Sheet: 6-mil- thick polyethylene sheet complying with ASTM D 4397.
   3. Slip Sheet: Building paper, 3-lb/100 sq. ft. minimum, rosin sized.

E. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
   1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A 153/A 153M or ASTM F 2329.

F. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

G. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

H. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.3 ROOF HATCHES

A. Roof Hatches: Fabricate roof hatch with insulated double-wall lid and insulated double-wall curb frame with integral deck mounting flange and lid frame counterflashing. Fabricate with welded or mechanically fastened and sealed corner joints. Provide continuous weathertight perimeter gasketing and equip with corrosion-resistant or hot-dip galvanized hardware.
   1. Loads: Fabricate roof hatches to withstand 40-lbf/sq. ft. external and 20-lbf/sq. ft. internal loads.
   2. Type and Size: Single-leaf lid 48-inch x 48-inch.
   3. Curb and Lid Material: Zinc-coated galvanized steel sheet, 14 gauge, 0.0747 inch thick.
      a. Finish: Powder coat.
   4. Insulation: Manufacturer's standard; 2 inches rigid polyisocyanurate, located on inside hollow curb and hatch lid.
   5. Fabricate units to minimum height of 12 inches, unless otherwise indicated.
   6. Hardware: Galvanized steel spring latch with turn handles, butt- or pintle-type hinge system, and padlock hasps inside and outside.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
   1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
   2. Underlayment: Where installing exposed-to-view components of roof accessories directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet, or install a course of polyethylene underlayment.

C. Roof Hatch Installation: Check roof hatch for proper operation. Adjust operating mechanism as required. Clean and lubricate joints and hardware.

D. Seal joints with elastomeric sealant as required by manufacturer of roof accessories.

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION 07 72 00

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes:
   1. Silicone joint sealants.
   2. Urethane joint sealants.
   3. Latex joint sealants.
   4. Butyl rubber based sealants.
   5. Joint sealant backing.
   6. Miscellaneous accessory materials.

B. Related Section includes Division 04 Section "Unit Masonry" for masonry control and expansion joint fillers and gaskets.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
   1. Use manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
   2. Submit not fewer than four pieces of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
   3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
   4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
   5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 SUBMITTALS

A. Product Data: For each joint sealant product indicated.

B. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch wide joints formed between two 6-inch long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint Sealant Schedule: Include the following information:
   1. Joint sealant application, joint location, and designation.
   2. Joint sealant manufacturer and product name.
   3. Joint sealant formulation.
   4. Joint sealant color.

E. Qualification Data: For qualified Installer and testing agency.

F. Product Certificates: For each kind of joint sealant and accessory, from manufacturer.

G. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each sealant specified to be validated by SWRI's Sealant Validation Program.

H. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that sealants comply with requirements.

I. Preconstruction Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.
   2. Test according to SWRI's Sealant Validation Program for compliance with requirements specified by reference to ASTM C 920 for adhesion and cohesion under cyclic movement, adhesion-in-peel, and indentation hardness.

D. Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.6 PROJECT CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.
   1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Stain-Test-Response Characteristics: Where sealants are specified to be nonstaining to porous substrates, provide products that have undergone testing according to ASTM C 1248 and have not stained porous joint substrates indicated for Project.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2 SILICONE JOINT SEALANTS

A. Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use NT; SEALANT A.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 790.
      b. GE Advanced Materials - Silicones; SilPruf LM SCS2700.
      c. Pecora Corporation; 890.
      d. Tremco Incorporated; Spectrem.

B. Mildew-Resistant, Single-Component, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SEALANT B:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Dow Corning Corporation; 786 Mildew Resistant.
      b. GE Advanced Materials - Silicones; Sanitary SCS1700.
      c. Tremco Incorporated; Tremsil 200 Sanitary.

2.3 URETHANE JOINT SEALANTS

A. Immersible Multicomponent, Nonsag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Uses T and I; SEALANT C.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. LymTal International, Inc.; Iso-Flex 885 SG.
      b. Pecora Corporation; Dynatred.
      c. Tremco Incorporated; Vulkem 227.

2.4 LATEX JOINT SEALANTS

A. Latex Joint Sealant: Acrylic latex or siliconized acrylic latex, ASTM C 834, Type OP, Grade NF; SEALANT D.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pecora Corporation; AC-20+.
      b. Tremco Incorporated; Tremflex 834.

2.5 SOLVENT-RELEASE-CURING JOINT SEALANTS

A. Butyl-Rubber-Based Joint Sealant: ASTM C 1311; SEALANT E.
   1. Products: Subject to compliance with requirements, provide one of the following at the thresholds:
      a. Bostik, Inc.; Chem-Calk 300.
      b. Pecora Corporation; BC-158.
      c. Tremco Incorporated; Tremco Butyl Sealant.

2.6 JOINT SEALANT BACKING

A. General: Provide sealant backings of material that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C 1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
   1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
   2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:
      a. Concrete.
      b. Masonry.
   3. Remove laitance and form-release agents from concrete.
   4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
      a. Metal.
      b. Glass.

B. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer or as indicated by preconstruction joint sealant substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
   1. Place sealants so they directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealant from surfaces adjacent to joints.
   2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
   3. Provide concave joint profile per Figure 8A in ASTM C 1193, unless otherwise indicated.
   4. Provide flush joint profile where indicated per Figure 8B in ASTM C 1193.
   5. Provide recessed joint configuration of recess depth and at locations indicated per Figure 8C in ASTM C 1193.
      a. Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.4 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.6 JOINT SEALANT SCHEDULE

A. Joint Sealant Application: Silicone Joint Sealant for exterior joints in vertical surfaces and horizontal nontraffic surfaces; and interior joints: SEALANT A.
   1. Joint Locations:
      a. Construction joints in cast-in-place concrete.
      b. Control and expansion joints in unit masonry.
      c. Joints between different materials listed above.
      d. Perimeter exterior joints between materials listed above and frames of doors, windows and louvers.

B. Joint Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces: SEALANT B.
   1. Joint Sealant Location:
      a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
      b. Joints subject to in-service exposures to wet conditions, high humidity and extreme exposures.
   2. Joint Sealant: Single component, nonsag, mildew resistant, acid curing.
   3. Joint Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint Sealant Application: Urethane Joint Sealant for joints in horizontal traffic surfaces subject to water immersion: SEALANT C.
   1. Joint Locations:
      a. Joints in exterior curbs and walks
      b. Isolation and control joints in exposed interior concrete floors.

D. Joint Sealant Application: Latex Joint Sealant for interior joints in vertical surfaces and horizontal nontraffic surfaces: SEALANT D.
   1. Joint Locations:
      a. Vertical joints on exposed surfaces of interior unit masonry and concrete walls.
      b. Joints on underside of plant-precast structural concrete beams and planks.
      c. Perimeter joints between interior wall surfaces and frames of interior doors, and louvers.

E. Joint Sealant Application: Butyl-Rubber-Based Joint Sealant in horizontal surfaces between different materials: SEALANT E.
   1. Joint Locations:
      a. Under door thresholds.

END OF SECTION 07 92 00

SECTION 08 17 46 – FRP ALUMINUM HYBRID DOORS IN THERMAL BREAK FRAMES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. SL-17 Pebble Grain FRP/ Aluminum Hybrid Door installed in Thermally Broken Aluminum Framing.

1.2 REFERENCES

A. AAMA 1304 - Voluntary Specification for Forced Entry Resistance of Side-Hinged Door Systems.

B. AAMA 1503-98 - Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections.

C. ANSI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance of Steel Doors and Hardware Reinforcing.

D. ASTM-B117 - Standard Practices for Operating Salt Spray (Fog) Apparatus.

E. ASTM-B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

F. ASTM-B221 - Standard Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

G. ASTM-C518 - Standard test Method for Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.

H. ASTM-D256 - Standard Test Methods for Determining the Pendulum Impact Resistance of Plastics.

I. ASTM-D570 - Standard Test Method for Water Absorption of Plastics.

J. ASTM-D638 - Standard Test Method for Tensile Properties of Plastics.

K. ASTM-D790 - Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

L. ASTM-D1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

M. ASTM-D1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics.

N. ASTM-D1623 - Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

O. ASTM-D2126 - Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.

P. ASTM-D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

Q. ASTM-D3029 - Test Methods for Impact Resistance of Flat Rigid Plastic Specimens by Means of a Tup (Falling Weight) (Withdrawn 1995) (Replaced by ASTM-D5420).

R. ASTM-D5116 - Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/ Products.

S. ASTM-D5420 - Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).

T. ASTM-D6670 - Standard Practice for Full-Scale Chamber Determination of Volatile Organic Emissions from Indoor Materials/ Products.

U. ASTM-E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

V. ASTM-E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

W. ASTM-E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

X. ASTM-E330 - Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

Y. ASTM-E1886 - Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials.

Z. ASTM-E1996 - Standard Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Storm Shutters Impacted by Wind Borne Debris in Hurricanes.

AA. ASTM-F476 - Standard Test Methods for Security of Swinging Door Assemblies.

BB. ASTM-F1642-04 - Standard Test Method for Glazing Systems Subject to Air Blast Loading.

CC. NWWDA T.M. 7-90 - Cycle Slam Test Method.

DD. NFRC 100 - Procedure for Determining Fenestration Products U-Factors.

EE. NFRC 400 - Procedure for Determining Fenestration Products Air Leakage.

FF. TAS 201 - Impact Test Procedures.

GG. TAS 202 - Criteria for Testing Impact & Nonimpact Resistant Building Envelope Components Using Uniform Static Air Pressure.

HH. TAS 203 - Criteria for Testing Products Subject to Cyclic Wind Pressure Loading.

1.3 SUBMITTALS

A. Action Submittals/Informational Submittals:
   1. Product Data: Submit manufacturer's product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.
   2. Shop Drawings: Submit manufacturer's shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
   3. Samples:
      a. Submit manufacturer's door sample composed of door face sheet, core, framing and finish.
      b. Submit manufacturer's sample of standard colors for door face and frame.
   4. Testing and Evaluation Reports: Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance

B. Closeout Submittals:
   1. Warranty Documentation: Submit manufacturer's standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications.
   1. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 25 years concurrent successful experience.
   2. Door and frame components must be fabricated by same manufacturer.
   3. Evidence of a documented complaint resolution quality management system.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Deliver materials to site in manufacturer's original, unopened, containers and packaging.
   2. Labels clearly identifying opening, door mark, and manufacturer.

B. Storage: Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.

C. Handling: Protect materials and finish from damage during handling and installation.

1.6 WARRANTY

A. Warrant doors, frames, and factory installed hardware against failure in materials and workmanship, including excessive deflection, faulty operation, defects in hardware installation, and deterioration of finish or construction in excess of normal weathering.

B. Standard Period: 10 years starting on date of shipment.

C. Limited lifetime: Covers failure of corner joinery, core deterioration, and delamination or bubbling of door skin and corrosion of all-fiberglass products while the door is in its specified application in its original installation.

D. Finish:
   1. Anodized, aluminum:10 years.

PART 2 - PRODUCTS

2.1 FRP/ALUMINUM HYBRID DOORS

A. Basis of Design Manufacturer:
   1. Special-Lite, Inc.
      a. PO Box 6, Decatur, Michigan 49045.
      b. Toll Free (800) 821-6531, Phone (269) 423-7068, Fax (800) 423-7610.
      c. Web Site www.special-lite.com.
      d. E-Mail info@special-lite.com.
   2. Subject to compliance with specifications, equivalent products by one of the following manufacturers may be provided:
      a. Kawneer North America: 555 Guthridge Ct., Technology Park, Norcross, GA 30092. Tel: (770) 449-5555.
      b. Cross Aluminum Products: 1770 Mayflower Rd., Niles, MI 49120. Tel: (269) 697-8340.

2.2 DOOR DESCRIPTION

A. Basis of Design Model: SL-17 Pebble Grain FRP/ Aluminum Hybrid Door.

B. Door Opening Size: As indicated on the Drawings.

C. Construction:
   1. Door Thickness: 1-3/4-inch.
   2. Stiles and Rails:
      a. Aluminum extrusions made from 6063 aluminum alloys with a minimum temper of T5.
      b. Minimum 2-5/16-inch deep one-piece extrusion with have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
      c. Screw or snap in place applied caps are not acceptable.
      d. Top rails must have integral legs for interlocking continuous extruded aluminum flush cap.
      e. Bottom rails must have integral legs for interlocking continuous weather bar with single nylon brush weather stripping or manually adjustable SL-301 door bottom with two nylon brush weather stripping.
      f. Meeting stiles to include integral pocket to accept pile brush weather seal.
   3. Corners:
      a. Mitered.
      b. Secured with 3/8-inch diameter full-width steel tie rod through extruded splines top and bottom which are integral to standard tubular shaped rails.
      c. 1-1/4-inch x 1-1/4-inch x 3/16-inch 6061 aluminum angle reinforcement at corner to give strong, flat surface for locking hex nut to bear on.
      d. Weld, glue, or other methods of corner joinery are not acceptable.
   4. Core:
      a. Poured-in-place polyurethane foam.
      b. Laid in foam cores are not acceptable.
      c. Foam Plastic Insulated Doors: IBC 2603.4.
      d. Foam plastic shall be separated from the interior of a building by an approved thermal barrier.
         1) Approved thermal barrier must meet the acceptance criteria of the Temperature Transmission Fire Test and Integrity Fire Test as stated in NFPA 275.
         2) IBC 2603.4.1.7 foam plastic insulation, having a flame spread index less than 75 and a smoke developed index of not more than 450 shall be permitted as a door core when the face is metal minimum 0.032-inch aluminum or 0.016-inch steel.
         3) Standard door assembly can be tested to show it meets these requirements without the use of thermal barrier. If no independent testing conducted all doors with foam plastic core must have a thermal barrier.
   5. Face Sheet:
      a. Exterior:
         1) 0.120-inch thick, pebble texture, through color with SpecLite 3® integral surfaseal film FRP sheet.
         2) Optional painted finish consult manufacturer.
         3) Class C.
      b. Interior:
         1) 0.120-inch thick, pebble texture, through color with SpecLite 3® integral surfaseal film FRP sheet.
         2) Optional painted finish consult manufacturer.
         3) Class C.
      c. Attachment of Face Sheet:
         1) Extruded stiles and rails to have integral reglets to accept face sheet on both interior and exterior side of door which secure face sheet into place and permit flush appearance.
         2) Use of glue to bond face sheet to core or extrusions is not acceptable.
   6. Cutouts: Manufacture doors with cutouts for required vision lites.
   7. Hardware:
      a. Pre-machine doors in accordance with templates from specified hardware manufacturers.
      b. Surface mounted closures will be reinforced for but not prepped or installed at factory.
      c. Factory install door hardware.
   8. Reinforcements:
      a. Aluminum extrusions made from 6061 or 6063 aluminum alloys.
      b. Sheet and plate to conform to ASTM-B209.
      c. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.
      d. Bars and tubes to meet ASTM-B221.

2.3 FRAMING

A. Framing:
1. Thermally Broken Aluminum Framing:
a. Model:
1) SL-600TB.
b. Materials.
1) See 2.5.A.
c. Perimeter Frame Members:
1) Storefront frame with thermally broken pocket filler.
2) Factory fabricated.
3) Open-back framing is not acceptable.
d. Thermal Strut: Fiber reinforced plastic, no other materials will be accepted.
e. Applied Door Stops:
1) 5/8-inch x 1-1/4-inch or 5/8-inch x 1-3/4-inch, 0.125-inch wall thickness, with screws and weather-stripping.
2) Provide solid 1/2-inch aluminum bar behind door stop for closer shoe attachment.
3) Pressure gasketing for weathering seal.
4) Counterpunch fastener holes in door stop to preserve full-metal thickness under fastener head.
5) Minimum 1/2-inch aluminum bar reinforcement under doorstop for required hardware attachments, aluminum to meet ASTM-B221.
f. Caulking: Caulk joints before assembling frame members.
g. Frame Member to Member Connections:
1) Secure joints with fasteners.
2) Provide hairline butt joint appearance.
3) Shear block construction only, no screw spline allowed.
h. Hardware:
1) Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
2) Surface mounted closures will be reinforced for but not prepped or installed at factory.
3) Factory install door hardware.
i. Anchors:
1) Anchors appropriate for wall conditions to anchor framing to wall materials.
2) Door Jamb and Header Mounting Holes: Maximum of 24-inch centers.
3) Secure head and sill members of transom, side lites, and similar conditions.

2.4 PERFORMANCE

A. Face Sheet:
1. Standard Interior and Exterior Class C 0.120-inch thick, pebble texture, through color with SpecLite 3® integral surfaseal film FRP sheet.
a. Flexural Strength, ASTM-D790: 21 x 103 psi.
b. Flexural Modulus, ASTM-D790: 0.7 x 106 psi.
c. Tensile Strength, ASTM-D638: 13 x 103 psi.
d. Tensile Modulus, ASTM-D638: 1.2 x 106 psi.
e. Barcol Hardness, ASTM-D2583: 55.
f. Izod Impact, ASTM-D256: 14.0 ft-lb/in.
g. Gardner Impact Strength, ASTM-D5420: 120 in-lb.
h. Water Absorption, ASTM-D570: 0.20%/24hrs at 77 degrees F.
i. Surface Burning, ASTM-E84: Flame Spread less than or equal to 200, Smoke Developed greater than or equal to 450.
j. Taber Abrasion Resistance, Taber Test: 0.007% Max Wt. Loss, cs-17 wheels, 1000g. Wt., 25 cycles.
k. Chemical Resistance:
1) Excellent Rating:
a) Acetic Acid, Concentrated.
b) Acetic Acid, 5%.
c) Bleach Solution.
d) Detergent Solution.
e) Distilled Water.

f) Ethyl Acetate.
g) Formaldehyde.
h) Heptane.
i) Hydrochloric Acid, 10%.
j) Hydrogen Peroxide, 3%.
k) Isooctane.
l) Lactic Acid, 10%.

l. USDA/FSIS Requirements:
1) FRP face sheet with SpecLite 3® integral surfaseal is a finished outer surface material that is rigid; durable; non-toxic; non-corrosive; moisture resistant; a light, solid color such as white; easily inspected; smooth or an easily cleaned texture.
2) FRP face sheet with SpecLite 3® integral surfaseal does not contain any known carcinogen, mutagen, or teratogen classified as hazardous substances; heavy metals or toxic substances; antimicrobials; pesticides or substances with pesticidal characteristics.

B. Door Core:
1. Density, ASTM-D1622: less than or equal to 5.0 pcf.
2. Compressive Properties, ASTM-D1621: Compressive Strength less than or equal to 60 psi, Compressive Modulus greater than or equal to 1948 psi.
3. Tensile and Tensile Adhesion Properties, ASTM-D1623: Tensile Adhesion, 3-inch x 3-inch FRP Facers greater than or equal to 53 psi, Tensile Adhesion, 1-inch x 1-inch Foam greater than or equal to 104 psi.
4. Thermal and Humid Aging, ASTM-D2126: Volume Change at 158 degrees F, 100% humidity, 14 days less than or equal to 13%.
5. Thermal Conductivity, ASTM-C518, Thermal Resistance greater than or equal to 0.10 m2K/W.

C. Door Panel:
1. Thermal Transmittance, AAMA 1503-98: U-Factor = 0.29 Btu/hr/ft² degrees F, CRFp = 55.
2. Indoor Air Quality, ASTM-D5116, ASTM-D6607: GreenGuard, GreenGuard Gold.

D. Door and Aluminum Tube Frame Assembly:
1. Physical Endurance, ANSI A250.4: 25,000,000 Cycles, No Damage.
2. Salt Spray, ASTM-B117: 500 hours minimum exposure.
3. Air Leakage, NFRC 400, ASTM-E283:
a. Opaque Swinging Door (< than 50% glass):
1) 0.01 cfm/sqft @ 1.57 psf.
2) 0.01 cfm/sqft @ 6.24 psf.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass):
1) 0.38 cfm/sqft @ 1.57 psf.
2) 0.73 cfm/sqft @ 6.24 psf.
4. Structural Performance, ASTM E-330:
a. Single or Pair of Doors, 8'-4" x 8'-2" overall size, single point latching.
1) ± 75 psf design pressure, pass.
5. Impact and Cycle Test, ASTM-E1886:
a. Single or Pair of Doors, 6'-8" x 7'-8" overall size, 3-point latching.
1) 9 lbs. missile @ 50 fps, minimum 3 impacts, no rips, tears, or penetrations.
2) ± 75 psf design pressure, pass.
6. Forced Entry, AAMA 1304:
a. Single or Pair of Doors, 6'-8" x 7'-8" overall size, 3-point latching.
1) 300lb Pull Test, pass.
7. Impact Test, TAS 201:
a. Single or Pair of Doors, 6'-8" x 7'-8" overall size, 3-point latching.
1) 9 lbs. missile @ 50 fps, minimum 3 impacts, no rips, tears, or penetrations.
8. Static Air Pressure, TAS 202:
a. Single or Pair of Doors, 6'-8" x 7'-8" overall size, 3-point latching.
1) ± 65 psf design pressure, pass.
2) Forced Entry, 300lb Pull Test, pass.
9. Cyclic Wind Pressure Loading, TAS 203:
a. Single or Pair of Doors, 6'-8" x 7'-8" overall size, 3-point latching.
1) ± 65 psf design pressure, pass.
10. Security Test, ASTM-F476: Minimum Grade 40.
11. Blast Test, ASTM-F1642: 6 psi @ 45 psi-msec, minimal hazard, operable.

E. Door and Thermally Broken Aluminum Frame Assembly:
1. Thermal Transmittance, NFRC 100:
a. Opaque Swinging Door (< than 50% glass):
1) U-Factor = 0.31 Btu/hr/ft² degrees °F.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass):
1) U-Factor = 0.64 Btu/hr/ft² degrees°F.
2. Air Leakage, NFRC 400, ASTM-E283:
a. Opaque Swinging Door (< than 50% glass):
1) 0.01 cfm/sqft @ 1.57 psf.
2) 0.01 cfm/sqft @ 6.24 psf.
b. Commercially Glazed Swinging Entrance Door (> than 50% glass):
1) 0.38 cfm/sqft @ 1.57 psf.
2) 0.73 cfm/sqft @ 6.24 psf.
3. Sound Transmission, ASTM-E90: STC = 30, OITC = 29.

2.5 MATERIALS

A. Aluminum Members:
1. Aluminum extrusions made 6061 or 6063 aluminum alloys.
2. Sheet and plate to conform to ASTM-B209.
3. Alloy and temper to be selected by manufacturer for strength, corrosion resistance, and application of required finish, and control of color.

B. Fiberglass: See 2.2.C.5.

C. Fasteners:
1. All exposed fasteners will have a finish to match material being fastened.
2. 410 stainless steel or other non-corrosive metal.
3. Must be compatible with items being fastened.

2.6 FABRICATION

A. Factory Assembly:
1. Door and frame components from the same manufacturer.
2. Required size for door and frame units, shall be as indicated on the drawings.
3. Complete cutting, fitting, forming, drilling, and grinding of metal before assembly.
4. All cut edges to be free of burs.
5. Welding of doors or frames is not acceptable.
6. Maintain continuity of line and accurate relation of planes and angles.
7. Secure attachments and support at mechanical joints with hairline fit at contact surfaces.

B. Shop Fabrication:
1. All shop fabrication to be completed in accordance with manufactures process work instructions.
2. Quality control to be performed before leaving each department.

2.7 FINISHES

A. Door.
1. Aluminum:
a. Anodizing: Class 1 Anodized Finish, minimum 0.7 mils thick. Color as scheduled on the Drawings.
2. FRP Face Sheets:
a. Through Color: Color as scheduled on the Drawings.

B. Frame:
   1. Anodizing:
      a. Class 1 Anodized Finish, minimum 0.7 mils thick: Color as scheduled on the Drawings.
         1) Durability against humidity, warping and cracking.
         2) Resists fading from UV rays.
         3) Natural, high-definition grains with the look and feel of real wood.
         4) Durable powder coat protects against scratching.

2.8 ACCESSORIES

A. Hardware:
   1. Pre-machine doors in accordance with templates from specified hardware manufactures and hardware schedule.
   2. Factory install hardware.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive doors.

B. Notify architect of conditions that would adversely affect installation or subsequent use.

C. Do no proceed with installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Ensure openings to receive frames are plumb, level, square, and in tolerance.

3.3 ERECTION

A. Install doors in accordance with manufacturer's instructions.

B. Install doors plumb, level, square, true to line, and without warp or rack.

C. Anchor frames securely in place.

D. Separate aluminum from other metal surfaces with bituminous coatings or other means approved by architect.

E. Set thresholds in bed of mastic and back seal.

F. Install exterior doors to be weathertight in closed position.

G. Repair minor damages to finish in accordance with manufacturer's instructions and as approved by architect.

H. Remove and replace damaged components that cannot be successfully repaired as determined by architect.

3.4 FIELD QUALITY CONTROL

A. Manufacture's Field Services: Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.5 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.6 CLEANING

A. Clean doors promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that would damage finish.

3.7 PROTECTION

A. Protect installed doors to ensure that, except for normal weathering, doors will be without damage or deterioration at time of substantial completion.

END OF SECTION 08 17 46

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:
1. Furnish hardware required to complete the work as shown on the drawings and as specified herein;
2. Furnish trim attachments and fastenings, specified or otherwise required, for proper and complete installation.
3. Furnish all items of Finish Hardware specified, scheduled, shown or required herein except those items specifically excluded from this section of the specification.
4. These documents supersede all previous hardware specifications and shall be followed without substitution. All acceptable products are listed within these hardware specifications.

B. Specific Omissions: Hardware for the following is specified or indicated elsewhere, unless specifically listed in the hardware sets:
1. Cabinet Hardware.
2. Signs, except as noted.
3. Folding partitions, except cylinders where detailed.
4. Sliding aluminum doors
5. Chain link and wire mesh doors and gates
6. Access doors and panels
7. Overhead and Coiling doors

1.2 REFERENCES

A. National Fire Protection Associations (NFPA):
1. NFPA 101-2009, "Life Safety Code"
2. NFPA 80-1999, "Installation of Fire Doors and Windows"

B. Michigan Building Code -2024

C. American National Standards Institute (ANSI):
1. ANSI A 156 Standards series.
2. ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities

1.3 DEFINITIONS

A. "Finish Hardware": Items required for swinging, sliding and folding doors, except special types of unique and non-matching hardware specified under door and frame Sections of these Specifications.

1.4 SYSTEM DESCRIPTION

A. Design requirements:

1. Review of hardware requirements:
   a. Thoroughly review finish hardware schedule, comparing it with the floor plan, door schedule, and door details to verify hardware requirements, quantities, door swings, finishes, and sizes.
   b. If an inconsistency or error in the proposed construction documents is suspected, the hardware supplier is to bring it immediately to the attention of the Architect. If the quantity of items is questioned, for bidding purposes, assume the higher quantity is required and price accordingly.
   c. Architect’s review of Submittals is for design concept only, and does not relieve the Contractor of the responsibility to furnish sufficient material and functions required for a complete and code-worthy installation. Determination of all quantities is the responsibility of the Contractor.

B. Performance requirements:
   1. Furnish finish hardware complying with the requirements of laws, codes, ordinances and guidelines of governmental authorities having jurisdiction:
      a. NFPA 101, “Life Safety Code”, 2009 edition
      b. NFPA 80, “Installation of Fire Doors and Windows”, 1999 edition
      c. Michigan Building Code -2024
      d. ICC/ANSI A117.1-2003 Accessible and Usable Buildings and Facilities

1.5 SUBMITTALS

A. Hardware Schedule
   1. Submit number of Hardware Schedules as directed in Division 01.
   2. Follow guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule unless noted otherwise.
   3. Schedule will include the following:
      a. Door Index including opening numbers and the assigned Finish Hardware set.
      b. Preface sheet listing category only and manufacturer's names of items being furnished as follows:

CATEGORY	**SPECIFIED**	**SCHEDULED**
Hinges	Manufacturer A	Manufacturer B
Lock sets	Manufacturer X	Manufacturer X
Kick Plates	Open	Manufacturer Z

      c. Hardware Locations: Refer to DHI Article 3.1 B.2 Locations.
      d. Opening Description: Single or pair, number, room locations, hand, active leaf, degree of swing, size, door material, frame material, and UL listing.
      e. Hardware Description: Quantity, category, product number, fasteners, and finish.
      f. Headings that refer to the specified Hardware Set Numbers.
      g. Scheduling Sequence shown in Hardware Sets.
      h. Product data of each hardware item, and shop drawings where required, for special conditions and specialty hardware.
      i. Electrified Hardware system operation description.
      j. "Vertical" scheduling format only. "Horizontal" schedules will be returned "Not Approved."
      k. Typed Copy.
      l. Double-Spacing.
      m. 8-1/2 x 11 inch sheets.
      n. U.S. Standard Finish symbols or BHMA Finish symbols.

B. Product Data:
   1. Submit, in booklet form Manufacturers Catalog cut sheets of scheduled hardware.
   2. Submit product data with hardware schedule.

C. Samples:
   1. Prior to submittal of the final hardware schedule and prior to final ordering of finish hardware, submit one sample, if required, of each type of exposed hardware unit, finished as required and tagged with full description for coordination with schedule.
   2. Samples will be returned to the supplier. Units, which are acceptable and remain undamaged through submittal, review and field comparison procedures, may, after final check of operation, be used in the work, within limitations of keying coordination requirements.

D. Submit to General Contractor/Construction Manager, the factory order acknowledgement numbers for the various hardware items to be used on the project. The factory order acknowledgement numbers shall help to facilitate and expedite any service that may be required on a particular hardware item. General Contractor/Construction Manager shall keep these order acknowledgement numbers on file in the construction trailer.

1.6 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the requirements and the methods needed for proper performance of the work of this Section.

B. Supplier qualifications:
   1. A recognized architectural finish hardware supplier with its' parent company located within 100 miles of the project site.
   2. Continuously in business of finish hardware supply for not less than 5 years.

C. Provide the service of a certified AHC (Architectural Hardware Consultant) to:
   1. Be available for consultation with the Architect at no additional cost to the Owner during progress of construction, and:
      a. Inspect installation of all finish hardware items;
      b. Make all minor adjustments required; and
      c. Report to the Architect on completeness of the installation.
   2. The hardware consultant may be an employee of the supplier.

D. Installer qualifications: Employ a competent hardware installer with at least five (5) years experience installing commercial grade hardware similar to that proposed for the Work.

E. Source limitations: Obtain each type of hardware (latch and lock sets, hinges, closers, etc.) from a single manufacturer, although several may be indicated as offering products complying with requirements. Products listed within these documents shall be used without substitution.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of Section 01 66 00.

B. Product identification:
   1. Tag and mark each item separately in manufacturers unopened package, identifying it by product number and architectural opening number, as listed in the approved Finish Hardware Schedule.
   2. Include instructions, templates, and fasteners needed for installation.

C. Deliver individually packaged hardware items on a vehicle operated by a direct employee of the Hardware Supplier. Contractor shall immediately, and in the presence of the Hardware Supplier, inventory the contents of the delivery.

D. Hardware supplier: Furnish finish hardware items directly to the factory or mill for factory-installation, where required.

1.8 PROJECT CONDITIONS

A. Provide a secure, well lit, dry storage area for the sole purpose of storing finish hardware. Prohibit access to all jobsite personnel, except those employed by the installing contractor.

1.9 WARRANTY

A. Manufacturer's warranty:
   1. Standard manufacturer's warranties apply for products listed in Part 2 products.
   2. Refer to Division 01 for further warranty requirements.

B. During the warranty period, replace defective work, including labor, materials and other costs incidental to the work. Replace work found to be defective as defined in the General Conditions.

C. Failures due to defective materials / workmanship to include, but not to be limited to:
   1. Failures in operation of any operating component;
   2. Defects which contribute to unsightly appearance, potential safety hazard, or potential untimely failure of the products furnished under this Section.

PART 2 - PRODUCTS

2.1 GENERAL

A. Requirements for design, grade, function, finish, size, and other distinctive qualities of each finish hardware item is indicated in the Finish Hardware Schedule at the end of this Section.

B. Product designations:
   1. One or more manufacturers are listed for each hardware type required. Product listed is for basis of design. Only products listed in part 2 product descriptions will be allowed for substitution.

C. ANSI/BHMA designations:
   1. Used to describe hardware items, or to define quality or function. Provide products complying with these standards in addition to additional requirements of this Section.

D. Hand of door: Drawings show direction of slide, swing (“hand”) of door leafs.

E. Hardware: Use hardware manufactured to conform to published templates and, generally, prepared for machine screw installation. Do not provide hardware which has been prepared for self-tapping sheet metal screws, except as specifically indicated.

2.2 MATERIALS

A. Base metals:
   1. Manufacturer's standard metal alloy, composition, temper and hardness, but in no case of lesser (commercially-recognized) quality than that specified for applicable hardware units by applicable ANSI A156 series standard for each type hardware item and with ANSI A156.18 for finish designations indicated.
   2. Do not furnish "optional" materials for those indicated, except as otherwise specified.

B. Fasteners:
   1. Furnish Phillips flat-head screws with each hardware item, unless otherwise indicated.
   2. Exposed screws: Match finish of hardware (even where noted to be "prepared for paint").
   3. Use concealed fasteners for hardware units which are exposed when door is closed, except where no standard units of type specified are available with concealed fasteners.
   4. Do not use thru-bolts where bolt head or nut on opposite face would be exposed.
   5. Where adequate reinforcement is not feasible, thru-bolting would only be acceptable if through sleeves, or if sex-screw fasteners are used.

C. Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of finish hardware.

2.3 MANUFACTURED UNITS, GENERAL

A. Reference standards:
   1. Comply with BHMA/ANSI A156 current series for each product type.

B. Hardware finishes:
   1. Materials and Finishes Standard: Comply with ANSI A156.18 Finish designations used in schedules are listed, therein.
   2. Provide matching finishes for hardware units at each door, unless otherwise indicated.
   3. Match the color and texture of hardware items to manufacturer's standard finish for the latchset, lockset, or push-pull unit.

4. Provide quality of finish, including thickness of plating or coating, composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than that specified or described by referenced standards.

C. Hardware for fire-rated openings:
1. Comply with NFPA 80
2. Tested and listed by Underwriters Laboratory (UL), or Factory Mutual (FM) for type, size and use of door, and complying with requirements of door and door frame label.
3. Provide UL or FM label on door indicating "Fire door to be equipped with fire-exit hardware".
4. Provide UL or FM label on exit device indicating "Fire Exit Hardware".

2.4 PRODUCTS

A. Hinges:
1. Continuous Hinges:
a. ANSI A156.26 – Grade 1.
b. Provide only template-produced units.
c. Hinges at exterior doors shall be of non-ferrous material.
d. Fasteners: Drill and tap each hole to receive each fastener, self-drilling fasteners not allowed.
e. Size hinge to door height, according to hinge manufacturer’s recommendation for door size and weight.
f. Acceptable products: PBB, Larson & Shaw, IDC, McKinney, Ives

B. Lock Cylinders and Keying:
1. General:
a. Supplier shall meet with Owner and Architect to finalize keying direction and furnish a complete key schedule. The key schedule shall include keysets, marks and key schedule corresponding to each opening.
2. Cylinders:
a. Type: Mortise or rim-type as required by function of locking device.
b. Provide screw on cams or tail piece as required.
c. Construct lock cylinder parts from brass/bronze, stainless steel or nickel silver.
d. Provide solid machined cylinder rings with tension spring to resist wrenching of cylinder. Length, finish and size as required.
e. Provide cylinder(s) and core(s) as required by function for each locking device.
3. System:
a. Provide temporary brass construction cores for each cylinder provided.
b. Provide combinated final cores & cut keys; keyed to the owner’s existing key system.
c. Provide cylinders/cores, from the same manufacturer of locksets, compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer’s series as indicated.
4. Keying:
a. Deliver keys and final cores to the hardware installation Contractor for final installation, when directed by the Owner.
b. Comply with Owner's instructions for master keying and, except as otherwise indicated, provide individual change key for each lock which is not designated to be keyed alike with a group of related locks.
c. Key material: Nickel silver
d. Key quantity:
1) Two (2) change keys for each lock; Two (2) core keys total.
2) Five (5) master keys for each lock

C. Locksets:
1. Mortise Locks
a. Comply with ANSI A156.13 - 1987, Grade 1 criteria for mortise locks.
b. Functions Indicated in the hardware sets.
c. Trim: Stainless Steel / Boston lever-type, equal to PDQ.
d. Locks shall be built in the USA.
e. Lockset case shall to be non-handed and have three-piece latches.
f. Acceptable products: PDQ MR 630, Sargent 8200 630, Schlage L9000 630

D. Door closers:
   1. General:
      a. ANSI A156.4 - 1986 Grade 1 criteria.
      b. All closers shall be the products of one manufacturer.
   2. Description:
      a. Full rack-and-pinion type
      b. Cast Iron Body.
      c. Hydraulic fluid: non-gumming and non-freezing.
      d. Closer body: non-handed, multi-size spring power.
      e. With three non-critical V valves and hex key adjustment to independently regulate sweep latch speed and backcheck.
      f. Provide mounting brackets necessary to clear sound seals and weatherstrip.
      g. Enclose in a full, molded cover.
      h. Provide drop plates or special brackets for proper mounting.
      i. Arms coted in rust / corrosion prohibitor finish.
      j. Provide Barrier Free power setting as required by ANSI A117.1
      k. Where SCS is specified, furnish a Stainless-Steel swivel snubber. Stationary snubbers, rubber grommets and studs will not be accepted.
   3. Acceptable products: PDQ 7000, LCN 4041XP SRI, Sargent 281 SRI

E. Stops:
   1. General:
      a. ANSI A156.16 - 1989 Grade 1 criteria.
      b. Provide stops where scheduled, wall or floor, as opening conditions dictate, utilizing wall stops wherever possible.
   2. Description:
      a. Wall stops: Cast brass, bronze or stainless steel. Concave wall stop to have stainless steel washer imbedded in rubber stop.
      b. Floor stops: Cast Stainless, brass or bronze, and plated as required.
      c. Make selection of floor stop height based upon floor conditions and door undercut.
      d. Provide magnetic hold-open wall stops where specified.
   3. Acceptable products: Don Jo, PDQ, Ives, Rockwood

F. Kick plates, mop plates and armor plates:
   1. General: ANSI A156.16 - 1989 criteria.
   2. Description:
      a. Minimum .050" thick
      b. Dimensions:
         1) Width: 2" less than door width to which they are to be applied.
         2) Kick plate height: 10"
   3. Mounting:
      a. Install kick plates and armor plates flush to bottom edge of door.
      b. Notch armor plates for lock or exit device trim or active case.
   4. Acceptable manufacturers: Don Jo, PDQ, Ives, Rockwood

G. Thresholds:
   1. General:
      a. ANSI A156.21 - 1989, Grade 1 criteria.
      b. Comply with A.D.A. requirements, unless otherwise scheduled.
   2. Description:
      a. Fiberglass, Flat profile
      b. Installation locations are scheduled.
      c. Provide templates for thresholds to related door suppliers to coordinate proper undercut.
   3. Acceptable products: Reese, Zero, KN Crowder

H. Door Seal and Inside Astragals:
   1. General:
      a. ANSI A156.21 - 1989, Grade 1 criteria.
   2. Description:
      a. Flat profile.
      b. Dimensions: Appropriate to door opening size.
      c. Installation locations are scheduled.
      d. Provide templates for thresholds to related door suppliers to coordinate proper undercut.
   3. Mounting:
      a. Apply related hardware (closer, foot bracket, strike, etc.) on top of hardware compatible type weatherstrip.
      b. Do not notch or splice weather strip.
      c. Adjust related template hardware locations, as required.
   4. Acceptable products: Reese, IDC, KN Crowder

I. Sweeps and strips:
   1. General:
      a. ANSI A156.21 - 1989, Grade 1 criteria.
   2. Description:
      a. Flat profile.
      b. Dimensions: Appropriate to door opening size.
      c. Installation locations are scheduled.
   4. Acceptable products: Reese, IDC, KN Crowder

J. Miscellaneous Hardware Equipment and Material:
   1. General:
      a. Provide items and types as specified

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the Architect.

2.6 HARDWARE FINISHES

A. General:
   1. Provide matching finishes for hardware units at each door or opening, to the greatest extent possible and except as otherwise indicated.
   2. Reduce differences in color and textures as much as commercially possible where the base metal or metal forming process is different for individual units of hardware exposed at the same door or opening.
   3. In general, match items to the manufacturer's standard finish for the latch and lock set (or push/pull units if no latch/lock sets) for color and texture.
   4. Provide finishes matching those established by BHMA or, if none established, match the Architect's sample.
   5. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness and other qualities complying with manufacturer's standards, but in no case less than that specified for the applicable units of hardware by referenced standards.
   6. Finish designations used in schedules and elsewhere listed in ANSI A156.18 "Materials and Finishes Standard", including coordination with the traditional U.S. finishes shown by certain manufacturers for their products.

B. Provide the following hardware finishes, unless otherwise scheduled:
   1. Dull Chrome, Stainless Steel, and Aluminum color pallet.

C. Base material: Manufacturer’s standard high-carbon steel, brass, or bronze.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 COORDINATION

A. Coordinate as required with other trades to assure proper and adequate provision in the work of those trades for interface with the work of this Section.

3.3 INSTALLATION

A. General:
   1. Install each item in its proper location firmly anchored into position, level and plumb, and in accordance with the manufacturer's recommendations.
   2. Handing, hardware heights, locations, and degree of opening swing are indicated in the Drawings and Finish Hardware Schedule.
   3. Mount finish hardware units:
      a. At recommended heights and locations as shown in approved finish hardware schedule, complying with requirements of the A.D.A., and pertinent provisions of the Building Code.
      b. To function at proper degree of opening of doors as indicated on approved finish hardware schedule.
      c. By manufacturer's template.
      d. Prior to final finishing of the door. Remove hardware to allow finishing of door, and permanently reinstall hardware upon completion of finishing operation.
   4. Reinforce, where necessary, the substrate to assure proper attachment.
   5. Drill and countersink units which are not factory-prepared for anchorage fasteners.
   6. Space fasteners and anchors in accordance with industry standards.

B. Installing closers:
   1. Mount closers per manufacturer's template and secure the Architect’s approval of the closer installation.
   2. The Contractor will be required to REPLACE doors onto which closers are improperly mounted at no additional cost to the Owner. Repair or patching of such doors will not be acceptable.

C. Installing Stops: Install all wall stops into reinforced wall or stud. Projection type wall stop & holders should be mounted 80” from finish floor, with sloped portion of the stop facing up / flat side down. Install floor stops out of the way foot traffic at a height high enough to accommodate any ramp or uneven floor condition.

D. Installing thresholds at exterior doors: Set in full bed of butyl-rubber, or polyisobutylene mastic sealant.

E. Installing weatherstrip: Install weatherstrip prior to installing closers, OH Stops or panic hardware. Template closers and panic devices from weatherstrip and install all closer / OH Stop shoe brackets and panic device strikes onto the weatherstrip without notching or cutting the weatherstrip.

F. Installing Sweeps: Install all sweeps on exterior side of opening.

3.4 FIELD QUALITY CONTROL

A. Inspection of final hardware installation: The Contractor, hardware suppliers, and Architectural Hardware Consultant (AHC) shall thoroughly check the quality of the installation and the functionality of each unit of finish hardware at all openings in the Work. The Hardware Supplier shall forward a detailed written report of all operational or installation deficiencies to the Architect and Contractor.

3.5 CLEANING AND ADJUSTING

A. Check and adjust each item of hardware and each door upon completion of final installation. Verify proper function, and replace units which cannot be made to operate freely and smoothly, as intended for the application.

B. Clean adjacent surfaces soiled by hardware installation.

3.6 FINISH HARDWARE SCHEDULE

Hardware Set 1 – Storeroom Lock [Always Locked] + Closer Stop
LW-1, PW-2

1	ea.	Continuous Hinges CH51	32D
1	ea.	Storeroom Lock MR 115 BJSJ SF7	32D
1	ea.	Closer 7101 BC SCS Stop x DPPA-BS-NFB (push side mount)	689
1	ea.	Fiberglass Threshold FBR 555	Grey
1	ea.	Sweep 354C –Mount pull side	AL
1	set	Weatherstrip by Aluminum Door Supplier	AL

END OF SECTION 08 71 00

SECTION 09 91 00 – PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and application of coating products, such as paints, stains and sealers, and labeling products.
   1. Surfaces to be painted or finished include, but are not necessarily limited to, the following interior and exterior surfaces for items furnished or installed under this Work, except as otherwise indicated on the Drawings or herein specified, [and existing surfaces specifically identified herein or on the Drawings]:
      a. Machinery and equipment.
      b. Ferrous metals, hangers, structural steel and joist framing.
      c. Galvanized steel.
      d. Exposed pipe and fittings including wall and floor sleeves (if pipe is insulated, insulation shall be painted).
      e. Exposed pipe, fittings, and pipe supports including surfaces between pipes and supports.
      f. Concrete block.
      g. Exterior concrete walls.
      h. Bottom side of exposed interior precast concrete.
      i. Exposed ducts and dampers.
      j. Exposed conduit and appurtenances (except conduit mounted on unpainted surfaces).
      k. Steel tanks.
      l. Steel ladders.
      m. Exposed metal deck.
      n. Steel stairways (except treads).
      o. Railings (except aluminum).
      p. Steel doors and frames.
      q. Exterior thermoplastic or fiberglass reinforced plastic tanks.
      r. Exposed above grade interior cast-in-place concrete.
      s. Exposed wood.
      t. Concrete stairways (except treads and risers).
      u. Plaster and drywall.
      v. Plywood; wood trim.
      w. Concrete floors.
      x. Immersed cast-in-place and precast concrete, except as excluded below.
      y. [Traffic striping.]
      z. All other surfaces not specifically excluded in the following paragraph. A completely finished project is required, regardless of whether every individual item is specified herein or indicated on the Drawings to be painted.
   2. Surfaces not to be painted or finished include the following unless otherwise indicated on the Drawings:
      a. [Immersed cast-in-place and precast concrete.]
      b. Interior, below grade walls and ceilings.
      c. Glass.
      d. Manufacturer's name and identification plates.
      e. Concealed ducts, pipes and conduits.
      f. Galvanized, aluminum and fiberglass grating.
      g. Prefinished electrical and control panels with factory applied final finish.
      h. Aluminum (unless specifically indicated to be painted).
      i. Door and window hardware.
      j. Stainless steel (unless specifically indicated to be painted).
      k. Prefinished wall, ceiling and floor coverings.
      l. Items with factory applied final finish, such as cabinets, anodized door and window frames, and the like, but excluding machinery and equipment.

m. Brick.
n. Structural glazed facing tile.
o. Items indicated on the Drawings as not to be painted.
p. PVC insulation jackets for pipe.

1.3 REFERENCES

A. Except as herein specified or as indicated on Drawings, the work of this Section shall comply with the pertinent provisions of the following:
1. [AASHTO:
   a. M247 - Glass Beads Used in Traffic Paint.
   b. M248 - Ready-Mixed White and Yellow Traffic Paint.]
2. ASME/ANSI: A13.1 - Scheme for the Identification of Piping Systems.
3. ASTM:
   a. A780 - Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   b. D16 - Terminology for Paint, Related Coatings, Materials, and Applications.
   c. D520 - Zinc Dust Pigment.
   d. D523 - Test Method for Specular Gloss.
   e. D7234 - Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers.
   f. F1869 - Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride.
4. Great Lakes Upper Mississippi River Board of State Public Health & Environmental Managers:
   a. Ten States Standards 2.14 - Recommended Standards for Water Works.
   b. Ten States Standards 54.5 - Recommended Standards for Wastewater Facilities.
   c. International Concrete Repair Institute: Guideline No. 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.
5. Michigan Administrative Code: R 325.51992 Part 603 - Lead Exposure in Construction.
6. National Association of Pipe Fabricators (NAPF):
   a. NAPF 500-03-01 - Solvent Cleaning for Ductile Iron.
   b. NAPF 500-03-02 - Hand Tool Cleaning for Ductile Iron.
   c. NAPF 500-03-03 - Power Tool Cleaning for Ductile Iron.
   d. NAPF 500-03-04 - Abrasive Blast Cleaning for Ductile Iron Pipe.
   e. NAPF 500-03-05 - Abrasive Blast Cleaning for Cast Ductile Iron Fittings.
7. NSF/ANSI/CAN Standards:
   a. 61 – Drinking Water System Components – Health Effects.
   b. 600 – Health Effects Evaluation and Criteria for Chemicals in Drinking Water.
8. Steel Structures Painting Council (SSPC):
   a. AB-1 - Mineral and Slag Abrasives.
   b. PA-1 - Shop, Field, and Maintenance Painting of Steel.
   c. PA-2 - Procedure for Determining Conformance to Dry Coating Thickness Requirements.
   d. PA-3 - A Guide to Safety in Paint Application.
   e. SP-1 - Solvent Cleaning.
   f. SP-2 - Hand Tool Cleaning (SSI-St2).
   g. SP-3 - Power Tool Cleaning (SSI-St3).
   h. SP-5 - White Metal Blasting (SSI-Sa3) (NACE #1).
   i. SP-6 - Commercial Blast Cleaning (SSI-Sa2) (NACE #3).
   j. SP-7 - Brush-off Blast (SSI-Sa1) (NACE #4).
   k. SP-8 - Pickling.
   l. SP-10 - Near-White Blast Cleaning (SSI-Sa2-1/2) (NACE #2).
   m. SP-11 - Power Tool Cleaning to Bare Metal.
   n. SP-16 - Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
   o. VIS-1 - Visual Standard for Abrasive Blast Cleaned Steel.
9. United States Department of Labor, Occupational Safety and Health Administration (OSHA): 29 CFR 1926.62.

1.4 DEFINITIONS

A. Terms:
1. Coating: Paint, stain, sealer or other product specified.
2. Environment:
a. Severe: Highly corrosive industrial atmospheres with sustained exposure to high humidity and condensation, frequent cleaning using strong chemicals, heavy concentrations of strong chemical fumes, and frequent splashing and spilling of harsh chemical products.
b. Moderate: Corrosive industrial atmospheres with intermittent exposure to high humidity and condensation, occasional mold and mildew development, regular cleaning with strong chemicals, and occasional splashing and spilling of chemical products.
c. Mild: Industrial atmospheres with normal exposure to moderate humidity and condensation, occasional mold and mildew development, infrequent cleaning with strong chemicals, low levels of mild chemical fumes, occasional splashing and spilling of chemical products, and normal outdoor weathering.
3. Exposure:
a. Environmental conditions to which different surfaces may be exposed as follows:
1) Concealed: Surfaces within the confines of a building or other enclosure not constantly exposed to weather, trapped moisture, high heat or other deteriorating conditions, and normally concealed from view.
2) Immersed:
a) Surfaces below a liquid surface or exposed to spray.
b) Surfaces exposed to spray include areas to 8 inches above maximum liquid surface in quiescent structures and to 18 inches above maximum liquid surface in mixed or agitated structures.
c) Immersed surfaces also include the interior surfaces of the floors, walls, and tops of fully or partially enclosed liquid containing structures, regardless of the liquid level.
3) Interior: Surfaces within the confines of a building or other enclosure not immersed or constantly exposed to weather, trapped moisture, high heat or other deteriorating conditions, and exposed to view.
4) Exterior:
a) Above Grade: Surfaces above finished grade and not included in 1), 2), or 3) above.
b) Below Grade: Surfaces below finished grade and not included in 1), 2), or 3) above.
4. Gloss Range (as determined by ASTM D523):
a. High Gloss: A high sheen finish of more than 70 when measured at a 60 degree meter.
b. Semi Gloss: A medium sheen finish of 35 - 70 when measured at a 60 degree meter.
c. Satin: A low-to-medium sheen finish of 15 - 35 when measured at a 60 degree meter.
d. Eggshell: A low sheen finish of 20 - 35 when measured at a 60 degree meter.
e. Flat: A lusterless or matte finish of less than 5 when measured at an 60 degree meter.

1.5 SUBMITTALS

A. Manufacturer's Literature: Specification data sheets and color charts for materials proposed for use on the Work. Provide Safety Data Sheets (SDS) as requested by Engineer.

B. Schedules:
1. Submit a finish schedule indicating rooms and other structures and systems to be coated, items or areas to be coated, the proposed coating system, including surface preparation, primer, intermediate/finish coats, application methods and color charts.
2. Schedule shall be submitted as a complete package.
3. No coatings may be applied until Engineer has made a complete review of the entire submittal.

C. Manufacturer's Certificates: Submit signed affidavit from coatings Manufacturer that submitted coatings are of same or better quality than those specified, and Manufacturer’s approval of applicator.

D. NSF/ANSI/CAN Certifications: Coating systems in contact with potable water, including water that is a part of a treatment process that will ultimately become potable water, require NSF/ANSI/CAN 61 and 600 certifications Submit evidence of current product certifications with the requirements of these standards. Certification from Testing Laboratories must demonstrate acceptable credentials to allow them to certify product conformance with the NSF/ANSI/CAN 61 and 600 standards.

E. Applicator's Experience: Submit written verification of experience required herein.

F. Product and Maintenance Schedules:
1. At or before the completion of the Work, submit complete lists, in a finish schedule, of the actual products used. Include item covered, coating Manufacturer's name, type of coating and color.
2. Provide pipe coding schedules listing pipe name, coating Manufacturer's name, type of coating and color.
3. Provide maintenance manuals detailing the proper procedures and materials to be used for maintenance and repainting of the various coatings.

1.6 QUALITY ASSURANCE

A. General:
1. Acceptability of materials and performance shall be determined by Engineer.
2. Testing or certifications may be required to aid Engineer's determination.
   a. Expense of testing and certifications when required and, unless noted otherwise in the Contract Documents, shall be borne by Contractor.
   b. If destructive testing is required, Contractor shall repair damaged area. Expense of repair shall be borne by Contractor.
   c. If initial testing results are unsatisfactory or yield failing results, additional testing will be required. Cost of additional testing shall be borne by Contractor.
3. Coating Reviews:
   a. Request, in writing, a review of each coat by Engineer of first finished surface of each type for color, texture and workmanship.
   b. First accepted surface of each type and color shall be visibly labeled by Engineer with removable label as Project standard for that type and color of item.
   c. Labels shall remain in place until painting is finished and accepted.
   d. For spray application, paint a surface of 100 square feet as a Project standard.
4. Work may be inspected as to proper surface preparation, pretreatment, priming, dry film thickness, curing, color, and workmanship.
5. Applicable standards, test methods, and inspection equipment includes, but is not necessarily limited to the following:
   a. SSPC-VIS-1 photographic blast cleaning standards (latest revision).
   b. Inspector's wet film and dry film thickness gages.
   c. Zorelco 369/PHD pin hole detector.
   d. Mark II Tooke Gage.

B. Coating Subcontractors:
1. Applicators shall have experience with the coating systems specified.
2. Experience shall be substantiated by previous project experience, certifications, seminar attendance, Manufacturer validation, or similar means.

C. Pre-Application Meeting:
1. Convene a pre-application meeting before the start of work and prior to ordering materials.
2. Require attendance of parties directly affecting work of this Section, including Engineer, applicator and coating Manufacturer’s technical representative.
3. Review the following as a minimum:
   a. Access and safety requirements.
   b. Heating, ventilation and humidity control measures to be utilized.
   c. How application information will be monitored and recorded, including responsible personnel, monitoring equipment, forms, and timely reporting of information recorded.
   d. Protection of surfaces not scheduled to be coated.
   e. Schedule of work.
   f. Surface preparation.
   g. Coating application.
   h. Daily log to be used.
   i. Repairs anticipated.
   j. Applicator’s field quality control.
   k. Cleaning procedures.

l. Testing procedures.
m. Protection of coating systems.
n. Coordination with Owner's activities.

D. Manufacturer's Services:
1. Arrange for Manufacturer's technical representative to provide the services indicated below.
2. Site Visits by the Manufacturer's Technical Representative:
a. The pre-application meeting.
b. A visit to observe surface preparation and review application techniques of components of the system.
c. A visit to review the completed installation.
3. Generally provide assurance and guidance for the entire coating system installation.
4. Written documentation required from the coating system Manufacturer:
a. A letter of acknowledgement that the coating system materials are specified to be used in a location and for a purpose that meets with the approval of the coating system Manufacturer and the intent of the Contract Documents. The signed letter shall certify that the Manufacturer's technical representative:
1) Is familiar with the Project, has attended meetings and is aware of the Project conditions and aware of associated products (i.e. filler resurfacers, primers, coatings and other products proposed for the Project).
2) Agrees with the intended application of their products as specified.
3) Agrees with the surface preparation specified, as completed.
4) Agrees with the specifications. If necessary, submit revisions to specifications.
5) Agrees that their products are compatible with associated products (i.e. concrete repair materials, existing coating systems, and other products proposed for the Project).
6) Agrees with the type and quantity of testing to be performed, to ensure their product is adequately installed.
7) Approval of surface preparation prior to proceeding with subsequent work.
8) Approval of filler resurfacing, if applicable.
9) Approval of primer.
10) Approval of DFT tests.

E. Installation Subcontractor's Supervising Site Representative:
1. On Site during work being performed.
2. Knowledgeable of all aspects of the work.
3. Review each day's agenda with crew, and with Contractor's and Engineer's Site representatives.
4. If a portion of the work becomes unclear as to the most appropriate direction, work shall stop until a consensus is reached by all parties, including the Engineer's representative and the Manufacturer's technical representative, as required.

F. Applicator's Project Record:
1. Applicator shall maintain a record for each day work is performed, and shall include a record of application process information. At a minimum, applicator's record shall include:
a. Material Manufacturer's batch numbers.
b. Surfaces to which material is applied.
c. Time of application.
d. Ambient temperature.
e. Substrate temperature.
f. Substrate moisture.
g. Relative humidity.
h. Dew point temperature.
i. Use of heating, dehumidification and ventilation equipment.
j. Unusual or important conditions, features, or events that occur before, during or after work is performed that day. Such information shall be referred to on previous or subsequent daily reports, when appropriate.
2. Submit for Project record.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original sealed containers of the Manufacturer with labels legible and intact. Include the following on labels on each container:
   1. Manufacturer's name.
   2. Type of coating.
   3. Manufacturer's stock number.
   4. Manufacturer's batch identification.
   5. Color name and number.
   6. Instructions for mixing and reducing, where applicable.
   7. Percent total solids by volume.
   8. Identification of toxic substances and special instructions.
   9. VOC content.

B. Storage:
   1. Store materials in tightly covered containers at a minimum ambient temperature of 45 degrees F.
   2. Store materials in a well ventilated area and in such a manner as to comply with safety requirements including applicable federal, state, and local rules and requirements.
   3. Storage shall also be in accordance with instructions of the paint Manufacturer and requirements of insurance underwriters.
   4. Maintain storage containers in a clean condition, free from foreign materials and residue:
      a. Protect from freezing.
      b. Keep storage area neat and orderly.
      c. Remove oily rags and waste daily and dispose of legally.

C. Handle volatile products carefully and use caution so as not to puncture containers. Keep open flame away from areas while handling containers and be aware of material flash points.

1.8 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Waterborne Paints:
      a. Apply only when temperature of surface to be painted and surrounding air are between 50 and 90 degrees F.
      b. Maintain temperature range throughout the minimum cure time recommended by the Manufacturer.
   2. Solvent-Thinned Paints:
      a. Apply only when temperature of surface to be painted and surrounding air are between 45 and 95 degrees F.
      b. Maintain temperature range throughout the minimum cure time recommended by the Manufacturer.
   3. Inclement Weather:
      a. Do not apply paint:
         1) In snow, rain, fog, or mist.
         2) When relative humidity exceeds 85%.
         3) When steel temperature is less than 5 degrees F above the dew point.
         4) To damp or wet surfaces.
      b. Painting may continue during inclement weather if surfaces and areas to be painted are enclosed and heated within temperature limits specified by the Manufacturer during application and drying periods. Refer to Article 1.7 for further restrictions.

B. Existing Painted Surfaces:
   1. When painting is specified over existing painted surfaces and existing coating types are not known, analyze samples of existing coatings using a laboratory approved by Engineer to determine generic type of coating present and the presence of lead.
   2. Submit written report from the lab to Engineer before coating is applied.
   3. Required modifications to painting schedule caused by existing paint shall not be justification for extra payment.

4. Existing Coat Bonding Failure:
   a. Remove existing coating by abrasive blasting or other means, obtaining surface cleanliness and profile required for coating specified without damaging the substrate to the point of affecting its appearance.
   b. Paint as new surface.
   c. Unforeseen failure conditions may be justification for extra payment.

C. Epoxy Coatings:
1. Do not expose epoxies during application and cure to sunlight and heaters that emit carbon dioxide and carbon monoxide.
2. Use caution when applying and curing epoxy coatings to ensure that surrounding areas are not occupied and that adequate ventilation and fresh air are present.

D. Contractor shall demonstrate acceptability of environmental conditions as required by Engineer.

1.9 EXTRA MATERIALS

A. Leave with Owner at least 1 gallon of each type and color of paint used for finish coats and 1 gallon of each type of thinner required.

B. Containers shall be tightly sealed and clearly labeled.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
1. Coatings:
   a. Tnemec.
   b. Carboline.
   c. International Paint.
   d. Sherwin Williams.

B. Single Manufacturer:
1. Materials selected for coating systems for each type of surface shall be the product of a single Manufacturer.
2. Provide primers and undercoats produced by the same Manufacturer as the finish coats.

C. VOC Compliance:
1. All individual coatings and coating systems shall have VOC levels at or below the EPA recommendations identified in 40 CFR Part 59 and the coating systems listed in the schedule.

D. VOC content shall be tested in accordance with EPA Method 24.

2.2 MATERIALS

A. Material Types:
1. NSF/ANSI/CAN Standards Certification:
   a. Coating systems in contact with potable water, including water that is a part of a treatment process that will ultimately become potable water, require NSF/ANSI/CAN 61 and 600 certifications.
   b. Products represented by manufacturers to have NSF/ANSI/CAN 61 and 600 have been included in the painting schedule, where the intended use requires products to meet the requirements of those standards. However the listing of a product is not a representation by the Engineer that the product has the current certifications. Submittal of current certifications is a requirement.
   c. Proposed substitutions shall also carry NSF/ANSI/CAN certifications for specific applications.
   d. Verify that coating systems utilized carry NSF/ANSI/CAN certifications, where such certifications are required. Provide product currently certified at no extra cost to Owner.
2. Paint, primer and related materials are included in the painting schedule in this Section.
3. Paint used for repair of galvanizing shall have minimum 95% zinc dust in accordance with ASTM D520.

B. Colors: Colors of finish coats shall be as selected by Engineer.

C. Blast Abrasives:
1. Level of ionic contaminants shall be in accordance with SSPC-AB 1.
2. Products and Manufacturers:
a. Magnum Blast by Dust Net, Wedron, Illinois.
b. Black Magnum by Dust Net, Wedron, Illinois.
c. Black Beauty by Reed Minerals, Highland, Indiana.

D. VOC Compliance:
1. Individual coatings and coating systems shall have VOC levels at or below the EPA recommendations identified in 40 CFR Part 59.
2. VOC content shall be tested in accordance with EPA Method 24.

2.3 MIXES

A. Mixing:
1. Deliver paints to the Site ready-mixed, when possible.
2. Mix two-component paints at the Site and observe pot life as recommended by Manufacturer.
3. Proceed with mixing until paint becomes smooth, homogeneous, and free of surface swirls or pigment lumps.
4. When mixing multi-component paints, remix each component individually, then blend the components, as recommended by the Manufacturer, until the mixture is completely uniform in color.

B. Thinning:
1. No thinning will be permitted unless absolutely necessary.
2. Paint shall be spray-applied in as-received condition to demonstrate necessity for thinning.
3. Use only thinners as recommended by paint Manufacturer for specific use.
4. Amount of thinner used shall be reported to Engineer.
5. Measure viscosity to ensure proper thinning ratios have been used.

C. Tinting:
1. Onsite tinting will be permitted only when accepted in writing by Engineer.
2. Use only tinting colors recommended by the Manufacturer for the specific type of coating.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspection:
1. Prior to the commencement of surface preparation or other coating activities, thoroughly inspect the surfaces to determine if the Work is ready to be prepared and painted.
2. Report in writing to Engineer conditions that may potentially affect proper application.
3. Do not commence surface preparation or other coating activities until such defects have been corrected.

B. Correction of Defects:
1. Correct defects and deficiencies in surfaces which may adversely affect work of this Section.
2. Apply filler resurfacers, patching materials and the like that are required to provide the surface recommended by the coating Manufacturer.
3. Start of painting will be construed as the applicator’s acceptance of surfaces and conditions within a particular area.

3.2 TEMPORARY HEATING, VENTILATION AND HUMIDITY CONTROL REQUIREMENTS

A. General:
1. Ventilation is mandatory.
2. Provide ventilation that exhausts fumes and odors to the exterior at a location where existing HVAC systems will not pick up these fumes and odors.
3. Provide negative air pressure to those spaces receiving coatings without reducing air temperatures in those spaces which may impede the curing process of those coating systems.

4. Ventilation is required during surface preparation, application of coating systems, and the curing period for those systems.
5. Provide additional equipment and fuel as required to condition the space for surface preparation, application of products, and curing of those products, in accordance with Manufacturer's requirements. This equipment may include, but is not limited to, heaters, dehumidifiers and fans for intake and exhaust air.

B. Enclosures:
1. Provide temporary enclosures as required to isolate dust, fumes and odors from areas in use, to control temperature and humidity, and to protect surface to be coated from the weather.
2. The enclosure shall be of such quality as to maintain optimal conditions for the work of this Section.
3. The enclosure shall remain until the work is sufficiently cured.

3.3 PREPARATION

A. General:
1. Prepare surfaces in accordance with this Article, the paint Manufacturer's recommendations and as specified in the painting schedule of this Section.
2. Cleanliness of Abrasive Blast-Cleaned Steel:
   a. Determined by Engineer using Steel Structures Painting Council Manual SSPC-VIS-1.
   b. Small steel panels which have been abrasive blast-cleaned and approved for a specific cleanliness may be used for comparative purposes to facilitate inspection and approval.
   c. Securely wrap these panels in clear plastic, seal to protect them from deterioration and mark with appropriate SSPC-SP6 cleaning specification.
3. Cleanliness of Compressed Airs:
   a. Do not use contaminated air for blast cleaning.
   b. Periodically check compressed air used for blasting to verify that it is clean, dry and oil-free by directing its flow toward a sheet of clean white paper.
4. Place oil and water separators in the air line as close as possible to blast-cleaning equipment. Make measurements of surface profile of abrasive blast-cleaned steel with a Keane-Tator Surface Profile Comparator or Testex Press-O-Film and Micrometer.
5. Abrasive Media:
   a. Select abrasive media to provide the type of profile required by the Manufacturer of the coating product.
   b. Abrasive media shall contain less than 5% free silica sand.
6. Protective Covers:
   a. Protect motors, bearings, chain drives, and other moving parts by wrapping with plastic and sealing with tape.
   b. Maintain protective covers in dust tight condition.
7. Correct steel and fabrication defects revealed by surface preparation, such as weld imperfections, delamination, scabs, and slivers, by appropriate trade before proceeding further with surface preparation.
8. Clean Up of Blast Cleaned Areas:
   a. Remove dust and blast products from the abrasive blast-cleaned surfaces by high pressure air or vacuum cleaning.
   b. Completely clean up residue from blasting operations within the entire space to be painted prior to applying coatings.
9. Inspect surfaces after surface preparation is complete and prior to application of coatings.
10. Remove hardware, accessories, plates, machined surfaces, lighting fixtures, and similar items in place that are not to be painted, or provide surface applied protection prior to surface preparation and painting, and then replace items after paint has dried.
11. When acid etching is the approved means of preparing surfaces for coating systems, protect the surrounding areas. Neutralize dispensed solutions and dispose of properly.

B. Moisture Testing of Concrete and Masonry Surfaces:
1. Securely tape a 12-inch x 12-inch piece of heavy gage plastic film to the surface in various locations.
2. Carefully seal the film with tape to prevent the escape of moisture and keep in place for a minimum of 16 hours.
3. If, after this period of time, moisture is present between the plastic and the surface, additional time for the material to dry will be required. Also, it may be appropriate to execute other means of testing for moisture.

4. Other Means of Testing for Moisture:
   a. ASTM F1869.
   b. Qualifying moisture meters capable of reading 2 to 100% moisture content on a surface.

C. Masonry Walls:
1. Do not coat new masonry walls for at least 28 days.
2. Test masonry for moisture content as specified herein.
3. Remove dirt, loose mortar, scale, powder and other foreign matter from masonry surfaces which are to be painted by scrubbing with a stiff brush.
4. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to thoroughly dry.
5. Remove stains from masonry surface caused by weathering or corroding metals with a solution of sodium metasilicate after being thoroughly wetted with water and allow to thoroughly dry.
6. Coat masonry walls prior to installation of wall mounted equipment.

D. Concrete:
1. Do not coat new concrete for at least 28 days.
2. Test concrete for moisture content as specified herein.
3. Remove oil and grease with a solution of tri-sodium phosphate prior to the commencement of coating or blasting activities.
4. Abrasive brush blasting shall create a CSP3 surface profile as defined by the International Concrete Repair Institute.
5. Provide additional surface preparation as may be required by the coating Manufacturer prior to application of coating systems.
6. Concrete shall be clean and dry before coating.
7. Prior to painting or sealing concrete floors, seal cracks and joints in floors with a sealant rated for traffic surfaces and compatible with the floor coatings specified.
   a. Prepare cracks by routing or other means, as recommended by sealant Manufacturer.

E. Ferrous Metals:
1. Non-Immersed Ferrous Metals:
   a. Surface Preparation - Shop:
      1) Remove dirt, oil, grease and other foreign matter in accordance with SSPC-SP1.
      2) Abrasive blast clean surfaces to specification required for coating to be applied.
      3) Perform abrasive blast cleaning only when the relative humidity is no higher than 75% and the surface temperature of the steel is at least 5 degrees F above the dew point.
      4) Coat cleaned surfaces before visible rust forms on the surface. Do not leave cleaned surfaces uncoated for more than 24 hours.
      5) Apply coating as specified under this Section.
   b. Surface Preparation - Field:
      1) Remove dirt, oil, grease and other foreign matter in accordance with SSPC-SP1.
      2) Prepare field welds by grinding to remove sharp edges, undercuts, recesses and pin holes.
      3) Completely remove weld slag and spatter.
      4) Thoroughly clean damages, scratches and abraded areas of shop primers. Thoroughly clean field welds and areas within 4 inches of field welds before painting using surface preparation methods at least as effective as those specified for the structure itself.
      5) Feather out edges to make touch-up patches inconspicuous.
      6) Clean surfaces with solvent.
      7) Contractor may, at Contractor's option, clean and apply one overall coat of primer for each specified shop coat in place of touch-up or spot priming.
      8) Contractor shall meet applicable surface preparation and application specifications.
2. Immersed Ferrous Metals:
   a. Surface Preparation - Field:
      1) Remove dirt, oil, grease and other foreign matter in accordance with SSPC-SP1.
      2) Prepare field welds by grinding to remove sharp edges, undercuts, recesses, and pin holes.
      3) Completely remove weld slag and spatter.
      4) Abrasive blast clean surfaces to specification required for coating to be applied.
      5) Perform abrasive blast cleaning only when the relative humidity is no higher than 75% and the surface temperature of the steel is at least 5 degrees F above the dew point.
      6) Coat cleaned surfaces before any visible rust forms on the surface.
      7) Do not leave cleaned surfaces uncoated for more than 24 hours.
      8) Apply coating as specified under this Section.

F. Ductile Iron Pipe and Fittings:
   1. Do not follow preparation procedures typically used for other ferrous metals as these may result in damage to the ductile pipe surface and subsequent reduced coating effectiveness and life expectancy.
   2. Perform surface preparation in accordance with NAPF 500-03-01 through 05 and the painting schedule.

G. Stainless Steel:
   1. Prepare welds by grinding to remove sharp edges, undercuts, recesses and pin holes.
   2. Remove dirt, oil, grease, and other foreign matter in accordance with SSPC-SP1.
   3. Use only solvents and cleaning solutions containing less than 200 ppm of halogens to prevent stress corrosion cracking.

H. Nonferrous Metals and Galvanized Steel:
   1. Remove dirt, oil, grease, and other foreign matter in accordance with SSPC-SP1. For Solvent Cleaning, test surface with copper sulfate solution. If galvanizing turns black, then surface is clean and ready for paint application. Otherwise abrade surface or brush blast in accordance with SSPC-SP7.
   2. Remove white rust by hand or power brushing being careful not to damage or remove the galvanizing.
   3. Remove rust in accordance with SSPC-SP2 or SSPC-SP3.
   4. On surfaces potentially exposed to the touch, such as railings, grind runs and drips of galvanizing material smooth and repair using zinc-rich primer.
   5. On galvanized steel, touch-up exposed metal areas using zinc-rich primer.
   6. Repairs and touch up of galvanized coatings shall comply with ASTM A780. Zinc-rich primers shall be compatible with finish coats.

I. Plaster:
   1. Do not coat new plaster for at least 28 days.
   2. Test plaster for moisture content as specified herein.
   3. Fill hairline cracks, small holes and imperfections on plaster surfaces with patching plaster.
   4. Smooth off to match adjacent surfaces.
   5. Wash and neutralize high alkali surfaces where they occur and allow to thoroughly dry.

J. Gypsum Drywall Construction:
   1. Sand with fine grit, open-coated sandpaper to provide a smooth, flat surface.
   2. Remove dust from surface by wiping with clean rags or other means.
   3. Prime steel corner beads with appropriate primer before applying wall primer.

K. Wood:
   1. Wipe off dust and grit from wood items and millwork prior to priming.
   2. Spot coat knots, pitch streaks, and sappy areas with sealer.
   3. Fill nail holes and cracks after primer has dried and sand between coats.
   4. Back prime interior and exterior woodwork.

L. Tanks and Equipment: Open doors, hatches, and covers, and remove removable appurtenances and prepare surfaces separately in accordance with this Section.

3.4 APPLICATION

A. General:
   1. Take necessary safety precautions in accordance with this Article, SSPC-PA Guide 3, Manufacturer's recommendations, federal, state, and local rules and requirements, and insurance underwriter’s guidelines.
   2. Apply coatings in accordance with this Article, SSPC-PA1, and the Manufacturer's recommendations.
   3. Moisture Content:
      a. Do not apply initial coating until moisture content of surface is within limitations recommended by paint Manufacturer.
      b. Determine moisture content by one of the following methods:
         1) As specified herein.
         2) By use of a moisture meter approved by Engineer.
   4. Mil Thickness:
      a. Apply coats in a uniform manner and of the minimum dry film thickness as indicated in the painting schedule.
      b. Maximum mil thickness shall be as recommended by coating Manufacturer.

c. Where the mil thickness is not indicated in the painting schedule, it shall be as recommended by coating Manufacturer.

5. Sand and dust between each coat to remove defects visible from a distance of 5 feet.
6. Additional Coats:
   a. Apply within recoat recommendation of the Manufacturer based on temperature and humidity variations.
   b. Schedule inspections so as to not interfere with recoat time.
7. Each coat shall be smooth, free of brush marks, streaks, laps or pile-up of paint, and skipped or missed areas.
8. Make edges of paint adjoining other materials or colors clean and sharp with no overlapping.
9. Spray apply coatings on hollow metal units.
10. Finish door tops, edges, and bottoms the same as exposed surfaces.
11. Except for contact surfaces, surfaces of fabricated assemblies that are inaccessible after erection shall receive field coats of paint before erection.
12. Ensure that concrete cracks and defects have been repaired prior to applying coating, then fill remaining depressions and crevices with paint if practical.
13. Protect wet paint against damage from dust or other detrimental foreign matter as much as is practicable.
14. Remove grills, covers, and access panels of mechanical and electrical systems and tanks from location and paint separately.
15. Paint the interior surface of ducts flat black in the immediate area of supply and exhaust grilles.
16. Omit application of masonry filler on acoustical masonry.
17. Coat concrete and masonry walls prior to mounting equipment.
18. Where equipment, piping, conduit or the like are removed from an existing painted surface, patch and paint the newly exposed surface as required so the newly exposed surface matches surrounding surfaces in coating and appearance.
19. Where epoxy coatings are scheduled over existing paint:
    a. Test existing paint and substrate for lifting or alligatoring.
    b. If existing paint lifts or alligators, remove it down to bare substrate.
20. Where a portion of a surface is to be coated, carry the coating to the nearest break point in the surface plane beyond the portion specified.

B. Valves, Fittings, and Supports:
1. Paint valves and fittings the same base color as the pipe they adjoin.
2. Paint floor stands the same base color as the pipe they adjoin.
3. Wall Brackets and Pipe Hangers:
   a. Paint the same base color as the wall or ceiling they adjoin.
   b. Use gray color if wall or ceiling is not painted.

3.5 PIPE AND EQUIPMENT IDENTIFICATION

A. General:
1. Identify non-buried piping installed as part of the Work in accordance with ASME/ANSI A13.1, this Section, as required in the pipe identification schedule, and as indicated on the Drawings.
2. Painting or banding of concealed piping above suspended ceilings is not required, but labels as specified following are required.
3. Identify pumps, tanks, and equipment.

B. Color Bands:
1. Where color bands are indicated for piping identification, use colored vinyl tape spaced every 6 feet, before and after each valve and where pipe enters and leaves each wall.
2. Band Widths:
   a. Pipe up to and including 2-inch diameter: 3/4-inch wide.
   b. Pipe 2-1/2-inch to 6-inch diameter: 2 inches wide.
   c. Pipe 8-inch to 12-inch diameter: 4 inches wide.
   d. Pipe 14-inch diameter and over: 6 inches wide.

C. Labels and Arrows:
1. Label pipes at intervals not to exceed 20 feet and where pipe enters and leaves each wall, to identify the contents of the pipe as determined by Engineer.
2. Place an arrow adjacent to every pipe label to indicate direction(s) of flow.

3. Use preprinted labels and arrows manufactured by a company which normally manufactures pipe identification systems.
4. Supply pipe labels, arrows, and color bands by a single Manufacturer.
5. Labels and Arrow Heights:
   a. Pipe or Covering Over 3-inch Diameter: 2-1/4 inches.
   b. Pipe or Covering 1-inch to 3-inch Diameter: 1-1/8 inches.
   c. Pipe or Covering Under 1-inch Diameter: 1/2-inch.
6. Materials shall be suitable for the use intended.
7. Label pumps, tanks, and equipment items, including description and tag number, with lettering size coordinated with Engineer depending on equipment size.

3.6 PHYSICAL HAZARDS IDENTIFICATION

A. General:
   1. Identify physical hazards of the facilities constructed and installed under this Work.
   2. Identify physical hazards in accordance with the requirements and standards of OSHA, and other governing state and local laws, ordinances, and codes.
   3. In the event of discrepancy between regulations and standards, the more strict requirements shall govern.

3.7 TEMPORARY HEATING, VENTILATION AND HUMIDY CONTROL REQUIREMENTS

A. General:
   1. Ventilation is mandatory.
   2. Provide ventilation that exhausts all fumes and odors to the exterior at a location where existing HVAC systems will not pick up these fumes and odors.
   3. Provide negative air pressure to those spaces receiving coatings without reducing air temperatures in those spaces which may impede the curing process of those coating systems.
   4. Ventilation is required during surface preparation, application of coating systems, and the curing period for those systems.
   5. Provide additional equipment and fuel as required to condition the space for surface preparation, application of products, and curing of those products, in accordance with Manufacture’s requirements. This equipment may include, but is not limited to, heaters, dehumidifiers and fans for intake and exhaust air.

3.8 ENCLOSURE

A. Construct weather-tight enclosures as required around the area being worked on. The enclosure shall be of such quality as to maintain optimal conditions for the work.

B. The enclosure shall be capable of isolating all dust, fumes and odors.

C. The enclosure shall remain until the repair work is sufficiently cured.

3.9 FIELD QUALITY CONTROL

A. Inspection:
   1. To facilitate painting and inspection, each coat of paint shall be of a different color or tint.
   2. Finished metal surfaces shall be free of skips, voids or pinholes in each coat when tested with a low voltage detector.
   3. Do not apply additional coats until previous coat has been inspected and acknowledged in writing by Engineer.
   4. Only coats of paint acknowledged in writing will be considered in determining number of coats applied.

B. Final Touch-Up:
   1. Surface damage shall be repaired with touch-up paint matching material used for original coating.
   2. Repaired areas shall be rubbed out and polished to match surrounding finish.
   3. Finish repair shall be of the quality typically found within the auto body industry.

3.10 CLEANING

A. Remove spilled, splashed, or spattered paint from surfaces.

B. Do not mar surface finish of item being cleaned.

C. Prior to acceptance of the work of this Section, thoroughly clean painted surfaces and related areas in accordance with Division 01 Section “Cleaning and Waste Management.”

3.11 PROTECTION

A. General:
   1. Adequately protect other surfaces from paint and damage.
   2. Repair damage as a result of inadequate or unsuitable protection.

B. Protective Materials: Furnish sufficient drop cloths, shields, and protective equipment to prevent spray or droppings from fouling surfaces not being painted and in particular, surfaces within storage and preparation area.

C. Fire Hazards: Place cotton waste, cloths, and materials which may constitute a fire hazard in closed metal containers and remove daily from Site.

D. Electrical Plates and Hardware:
   1. Remove electrical plates, surface hardware, fittings and fastenings prior to painting operations.
   2. These items are to be carefully stored, cleaned and replaced upon completion of work in each area.
   3. Do not use solvent to clean hardware that may remove permanent lacquer finish.

E. Equipment with Factory-Applied Final Finishes:
   1. Certain equipment with factory-applied finishes may be accepted by Engineer at Engineer‘s discretion.
   2. Protect finishes of equipment with approved factory-applied final finishes from scratches and abrasions by all practical means.
   3. Repair surface damage with touch-up paint furnished by equipment Manufacturer by workmen skilled in this type of work.
   4. Rub out and polish repaired areas to match surrounding finish.
   5. Finish repair shall be of the quality typically found within the auto body industry.
   6. If damage to item is severe in the judgment of Engineer, the equipment will be rejected or a new finish coat shall be applied after proper surface preparation at the discretion of Engineer, at no additional cost to Owner.

3.12 PAINTING SCHEDULE

A. The following schedule indicates systems by all acceptable manufacturers. See Article 2.1 for acceptable Manufacturers.

B. All mil thicknesses indicated are dry film thicknesses (DFT).

1. Interior Ferrous Metals – Non-Immersed: Gloss Zinc/Aliphatic Acrylic Polyurethane System:

System Manufacturer	Surface Preparation	First Coat	Second Coat	Third Coat
Tnemec	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): 90-97 Tneme-Zinc 2.5-3.5 Mils	(Field): 69-Hi-Build Epoxoline 4.0-6.0 Mils	(Field): 1094 Endura-Shield 3.0-5.0 Mils
Carboline	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): Carbozinc 859 2.5-3.5 Mils	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carbothane 134HG 3.0-5.0 Mils
International Paint	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): CATHCOAT 302 H Reinforced Inorganic Zinc (78%) 2.5-3.5 Mils	(Field): BAR-RUST 235 Epoxy Mastic 4.0-6.0 Mils	(Field): DEVTHANE 379/H Aliphatic Urethane Gloss 3.0-5.0 Mils
Sherwin Williams	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): Corothane | Galvapac 1K 2.5-3.5 Mils	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Acrolon 218HS/HS Polyurethane 3.0-5.0 Mils

2. Interior Non-Ferrous and Galvanized Metals – Non-Immersed: Gloss Zinc/Aliphatic Acrylic Polyurethane System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field) 69 Hi-Build Epoxoline II 4.0-6.0 Mils	(Field): 1094 Endura-Shield 2.0-3.0 Mils
Carboline	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carbothane 134HG 2.0-3.0 Mils
International Paint	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): DEVRAN 201H or 203 Universal Epoxy Primer 2.0-4.0 Mils	(Field): DEVTHANE 379/H Aliphatic Urethane Gloss 2.0-3.0 Mils
Sherwin Williams	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Acrolon 218HS/HS Polyurethane 2.0-3.0 Mils

3. Exterior Ferrous Metals – Non-Immersed: Gloss Zinc/Aliphatic Acrylic Polyurethane System:

System Manufacturer	Surface Preparation	First Coat	Second Coat	Third Coat
Tnemec	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): 90-97 Tneme-Zinc 2.5-3.5 Mils	(Field): 69-Hi-Build Epoxoline 4.0-6.0 Mils	(Field): 1094 Endura-Shield 2.0-3.0 Mils
Carboline	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): Carbozinc 859 2.5-3.5 Mils	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carbothane 134HG 2.0-3.0 Mils
International Paint	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): CATHCOAT 302 H Reinforced Inorganic Zinc 2.5-3.5 Mils	(Field): BAR-RUST 235 Epoxy Mastic 4.0-6.0 Mils	(Field): DEVTHANE 379/H Aliphatic Urethane Gloss 2.0-3.0 Mils
Sherwin Williams	(Shop): SSPC-SP6 commercial blast cleaning	(Shop) and (Field Touch-up, Prime): Corothane | Galvapac 1K 2.5-3.5 Mils	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Acrolon 218HS/HS Polyurethane 2.0-3.0 Mils

4. Exterior Non-Ferrous and Galvanized Metals – Non-Immersed: Gloss Zinc/Aliphatic Acrylic Polyurethane System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils	(Field): 1094 Endura-Shield 4.0-6.0 Mils
Carboline	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carbothane 134HG 4.0-6.0 Mils
International Paint	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): DEVRAN 201H or 203 Universal Epoxy Primer 2.0-4.0 Mils	(Field): DEVTHANE 379/H Aliphatic Urethane Gloss 4.0-6.0 Mils
Sherwin Williams	(Field): SSPC-SP1 solvent cleaning and SSPC-SP3 or SSPC-SP7 (abrade to create a 1.0 - 1.5 mil profile)	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Acrolon 218HS/HS Polyurethane 4.0-6.0 Mils

5. Metals – Immersed (Potable Water Systems): Satin Polyamidoamine Epoxy System

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): SSPC-SP10 near-white blast cleaning	(Field): 21 Epoxyoline 3.0-5.0 Mils	(Field): 21 Epoxoline 4.0-6.0 Mils
Carboline	(Field): SSPC-SP10 near-white blast cleaning	(Field): Carboguard 891 VOC 3.0-5.0 Mils	(Field): Carboguard 891 VOC 4.0-6.0 Mils
International Paint	(Field): SSPC-SP10 near-white blast cleaning	(Field): BAR-RUST 233H Multi-Purpose Epoxy 5.0-6.0 Mils	(Field): BAR-RUST 233H Multi-Purpose Epoxy 5.0-6.0 Mils
Sherwin Williams	(Field): SSPC-SP10 near-white blast cleaning	(Field): Sherplate 600 3.0-5.0 Mils	(Field): Sherplate 600 4.0-6.0 Mils

6. Metals – Immersed (interior of potable water system pipe): Modified Polyamine or Satin Polyamidoamine Epoxy System

System Manufacturer	Pipe and Fitting Size Limitations	Surface Preparation	First Coat	Second Coat
Tnemec	Pipes 4” to 8” diameter	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): 22 Epoxoline 16.0-18.0 Mils	
	Pipes 10” to 12” diameter	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): 22 Epoxoline 16.0-18.0 Mils	
	Pipes 14” diameter and greater; valves and fittings 4” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): 22 Epoxoline16.0-18.0 Mils	
Carboline	Pipes 4” to 8” diameter; fittings		No NSF/ANSI/CAN certified equivalent	
	Valves 4” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): Carboguard 891 VOC 4.0-10.0 Mils	(Shop): Carboguard 891 VOC4.0 – 10.0 Mils (16.0 mils min, 20.0 mils max total)
	Pipes 10” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): Phenoline Tankshield 16.0-20.0 Mils	
International Paint	Pipes 4” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): Interline 975P 16.0-18.0 Mils	
	Valves and fittings 4” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): Bar Rust 233 H 12.0-16.0 Mils	
Sherwin Williams	Valves and fittings	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): Duraplate 6000 20.0-50.0 Mils	
	Pipes 4” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop): Duraplate 6000 20-50 Mils >=4” 20-125 Mils >=6””	
	Pipes 6” diameter and greater	(Shop): SSPC-SP10 near-white blast cleaning	(Shop) Sherplate PW Epoxy 16.0-30.0 Mils >=6” 16.0-50.0 Mils >=12”	

7. Existing Ferrous Metals in Wet Environment:

System Manufacturer	Surface Preparation	First Coat	Second Coat	Third Coat
Tnemec	(Field): SSPC-SP6 commercial blast cleaning	(Field): Series 1 Omnithane 2.5-3.5 Mils	(Field): 69 Hi-Build Epoxoline II 3.0-5.0 Mils	(Field): 69 Hi-Build Epoxoline II 2.0-3.0 Mils
Carboline	(Field): SSPC-SP6 commercial blast cleaning	(Field): Carbomastic 615 2.5-3.5 Mils	(Field): Carbomastic 615 3.0-5.0 Mils	(Field): Carbothane 134 HG 2.0-3.0 Mils
International Paint	(Field): SSPC-SP6 commercial blast cleaning	(Field): CATHCOAT 302 H Reinforced Inorganic Zinc 2.5-3.5 Mils	(Field): BAR-RUST 233H Multi-Purpose Epoxy 5.0-6.0 Mils	(Field): BAR-RUST 233H Multi-Purpose Epoxy 5.0-6.0 Mils
Sherwin Williams	(Field): SSPC-SP6 commercial blast cleaning	(Field): Corothane | Galvapac 1K 2.5-3.5 Mils	(Field): Macropoxy 646 FC 3.0-5.0 Mils	(Field): Macropoxy 646 FC 2.0-3.0 Mils

8. Precast Concrete – Non-Immersed: Satin Polyamidoamine Epoxy System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): See Paragraph 3.3.D.	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carboguard 890 4.0-6.0 Mils
International Paint	(Field): See Paragraph 3.3.D.	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Macropoxy 646 FC 4.0-6.0 Mils

9. Precast Concrete – Non-Immersed: Flat Acrylic Emulsion System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): See Paragraph 3.3.D.	(Field): 1026 Enduratone 2.0-3.0 Mils	(Field): 1026 Enduratone 2.0-3.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Carbocrylic 3358 2.0-3.0 Mils	(Field): Carbocrylic 3358 2.0-3.0 Mils
International Paint	(Field): See Paragraph 3.3.D.	(Field): Intercryl 520 Primer & Finish 2.0-3.0 Mils	(Field): Intercryl 520 Primer & Finish 2.0-3.0 Mils
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): DTM Acrylic Primer/Finish 2.0-3.0 Mils	(Field): DTM Acrylic Primer/Finish 2.0-3.0 Mils

10. Cast-In-Place Concrete – Non-Immersed: Satin Polyamidoamine Epoxy System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): See Paragraph 3.3.D.	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carboguard 890 4.0-6.0 Mils
International Paint	(Field): See Paragraph 3.3.D.	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Macropoxy 646 FC 4.0-6.0 Mils

11. Cast-In-Place Concrete: Flat Acrylic Emulsion System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): See Paragraph 3.3.D.	(Field): 1026 Eduratone 2.0-3.0 Mils	(Field): 1026 Enduratone 2.0-3.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Carbocrylic 3358 2.0-3.0 Mils	(Field): Carbocrylic 3358 2.0-3.0 Mils
International Paint	(Field): See Paragraph 3.3.D.	(Field): Intercryl 520 Primer & Finish 2.0-3.0 Mils	(Field): Intercryl 520 Primer & Finish 2.0-3.0 Mils
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): DTM Acrylic Primer/Finish 2.0-3.0 Mils	(Field): DTM Acrylic Primer/Finish 2.0-3.0 Mils

12. Cast-In-Place Concrete: Flat Acrylic Emulsion System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): See Paragraph 3.3.D.	(Field): 181 Tneme-Crete WB 8.0-10.0 Mils	(Field): 181 Tneme-Crete WB 8.0-10.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Flexxide Elastomer 8.0-10.0 Mils	(Field): Flexxide Elastomer 8.0-10.0 Mils
International Paint		No product identified	No product identified
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): Loxon XP 8.0-10.0 Mils	(Field): Loxon XP 8.0-10.0 Mils

13. Cast-In-Place Concrete Floors – Gloss Polyamidoamine Epoxy System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): SSPC-SP13/ICRI-CSP3	(Field): 280 Series Tneme-Glaze 6.0-12.0 Mils	(Field): 280 Series Tneme-Glaze 6.0-12.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete or use a Blastrac Machine (obtain profile of ICRI-CSP3)	(Field): Dudick SteriFlor U or GP 6.0-12.0 Mils	(Field): Dudick SteriFlor U or GP 6.0-12.0 Mils
International Paint		No product identified	No product identified
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): Resuflor 3746 6.0-12.0 Mils	(Field): Resuflor 3746 6.0-12.0 Mils

14. Cast-In-Place Concrete Floors: Sealer:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	Field SSPC-SP 13/CRI CSP 3	(Field) 201 Epoxoprime 6.0-8.0 Mils	(Field) 237 Power-Tread 6.0-8.0 Mils
L&M Construction Chemicals	(Field): See Paragraph 3.3.D.	(Field): Durathane HS 300 sf/gal	(Field): Durathane HS 400 sf/gal
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete or use a Blastrac Machine (obtain profile of ICRI-CSP3)	(Field): Carboguard 1340 300 sf/gal	Field): Carboguard 1340
Sherwin Williams	(Field): See Paragraph 3.3.D.	(Field): Armorseal 8100 2.0-5.0 Mils	(Field): Armorseal 8100 2.0-5.0 Mils

15. Cast-In-Place Concrete Walls, Beams and Ceilings: Sealer:

System Manufacturer	Surface Preparation	First Coat
All Manufacturers	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete or use a Blastrac Machine (obtain profile of ICRI-CSP3)	(Field): To match that specified in Division 3 Section “Cast-in-Place Concrete”

16. Interior Concrete Block: Satin Polyamidoamine Epoxy System:

System Manufacturer	Surface Preparation	First Coat	Second Coat	Third Coat
Tnemec	(Field): See Paragraph 3.3.C..	(Field): 130 Envirofill 60-80 sf/gal	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils	(Field): 69 Hi-Build Epoxoline II 4.0-6.0 Mils
Carboline	(Field): SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Sanitile 100 60-80 sf/gal	(Field): Carboguard 890 4.0-6.0 Mils	(Field): Carboguard 890 4.0-6.0 Mils
International Paint	(Field): See Paragraph 3.3.C..	(Field): Devran 224V Epoxy Block Filler 60-80 sf/gal	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils
Sherwin Williams	(Field): See Paragraph 3.3.C..	(Field): Pro Industrial Heavy Duty Block Filler 60-80 sf/gal	(Field): Macropoxy 646 FC 4.0-6.0 Mils	(Field): Macropoxy 646 FC 4.0-6.0 Mils

17. Exterior Concrete Block: Flat Acrylic Masonry Textured System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): See Paragraph 3.3.C..	(Field): 181 Tneme-Crete WB 8.0-10.0 Mils	(Field): 181 Tneme-Crete WB 8.0-10.0 Mils
Carboline	(Field): SSPC-SP13/NACE No. 6 – Surface Preparation of Concrete	(Field): Flexxide Elastomer 8.0-10.0 Mils	(Field): Flexxide Elastomer 8.0-10.0 Mils
International Paint		No product identified	No product identified
Sherwin Williams	(Field): See Paragraph 3.3.C..	(Field): Ultra-Crete 8.0-10.0 Mils	(Field): Ultra-Crete 8.0-11.0 Mils

18. Interior Insulated Pipe and Duct: Satin Acrylic Epoxy System:

System Manufacturer	Surface Preparation	First Coat	Second Coat
Tnemec	(Field): Clean and dry	(Field): 69 Hi-Build Epoxoline II 2.0-3.0 Mils	(Field): 1026 Enduratone 4.0-6.0 Mils
Carboline	(Field): SSPC-SP1 – Solvent cleaning	(Field): Sanitile 120 2.0-3.0 Mils	(Field): Sanitile 255 4.0-6.0 Mils
International Paint	(Field): Clean and dry	(Field): DEVRAN 201H or 203 Universal Epoxy Primer 2.0-4.0 Mils	(Field): DEVRAN 224V Hi-Solids Epoxy 4.0-6.0 Mils
Sherwin Williams	(Field): Clean and dry	(Field): DTM Acrylic Primer/Finish 2.0-3.0 Mils	(Field): ProIndustrial WB HB Epoxy 4.0-6.0 Mils

3.13 PIPE IDENTIFICATION COLOR SCHEDULE

A. Identify exposed pipes with the following colors.
   1. Colors are from the Tnemec Colorbook color card.
   2. Equivalent colors of other Manufacturers indicated in Part 2 of this Section may be used.

B. Where a facility has an existing identification system already in use, coordinate with the system in use.

C. In situations where 2 colors do not have sufficient contrast to easily differentiate between them, paint a 6-inch band of contrasting color at 30-inch intervals.

Water Plant Piping	Color Description	Tnemec Colorbook ID
Raw Water	Olive Green	Meadow 20 GN
Potable/Finished/High Service Water	Dark Blue	Safety Blue 11SF
Nonpotable/Service/Plant Utility Water	Light Blue with Red Bands	Teardrop 37BL with Red Bands
Drain Lines, Vent Lines	Gray	Slate Gray 31GR
Sanitary Lines	Dark Gray	Gray 33GR
Other Lines	Gray	Slate Gray 31GR

END OF SECTION 09 91 00

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 COORDINATION

A. Coordinate type and capacity of fire extinguishers with support brackets to ensure fit.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 6 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      Amerex Corporation.
      a. Ansul Incorporated.
      b. Guardian Fire Equipment, Inc.
      c. JL Industries, Inc.; a division of the Activar Construction Products Group.
      d. Larsens Manufacturing Company.
      e. Nystrom Building Products.

2. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Fire Extinguishers:
1. FE3: 10 lb. Multi-Purpose Dry Chemical. UL-rated 4-A; 80-B:C, nominal capacity, with monoammonium phosphate-based dry chemical in manufacturer's standard enameled container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
Amerex Corporation.
a. Ansul Incorporated.
b. Guardian Fire Equipment, Inc.
c. JL Industries, Inc.; a division of the Activar Construction Products Group.
d. Larsens Manufacturing Company.
e. Nystrom Building Products.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
1. Mounting Brackets: 54 inches above finished floor to top of fire extinguisher.

C. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 22 05 00 – GENERAL PLUMBING PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes specifying the general requirements for execution of that portion of the Work defined in Division 22 of these Specifications and as indicated on the Drawings:
   1. Major items include, but are not necessarily limited to:
      a. Cutting and patching.
      b. Support steel.
      c. Piping and fittings.
      d. Excavation and backfilling required.
      e. Labor, materials, equipment, tools, supervision, and start-up services.
      f. Incidental and related items necessary to a complete and functionally operational installation of the Work.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
   1. General Contractor:
      a. Refer to Division 01 Section “Cutting and Patching.”
      b. Provide access doors in walls and ceilings for access to plumbing equipment.
   2. Plumbing Subcontractor:
      a. Refer to Division 01 Section “Cutting and Patching.”
      b. Furnish location, size, and quantity of openings to Contractor before construction of new walls, ceilings, and floors.
      c. Provide excavation and backfilling required in connection with the Work of Division 22.
      d. Provide miscellaneous structural steel required in connection with support of the Work of Division 22.
      e. Perform final cleaning of plumbing systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of Division 22 shall comply with the following:
   1. ANSI:
      a. A13.1 - Standard for the Identification of Piping Systems.
      b. NSF/ANSI 61-2012 – Drinking Water System Components, Health Effects.
      c. NSF/ANSI 372 – 2011 – Drinking Water System Components, Lead Content.
   2. ASME: B31.9 - Building Services Piping.
   3. ASTM: A325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   4. EPA: US Safe Drinking Water Act (US SDWA) – 2014.
   5. Michigan:
      a. Building Code of 2015.
      b. Plumbing Code of 2021.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Construction details, components, accessories, sizes and model numbers indicated on the Drawings or in these specifications are used to indicate minimum levels of quality and coordination requirements.

B. Drawings:
   1. Are diagrammatic and indicate general arrangement of systems and work included.
   2. Do not necessarily indicate every required fitting, elbow, transition, and mounting support.
   3. Shall not be scaled for measurement or installation location.
   4. Shall not serve as Shop Drawings.

C. Schedules and model numbers shall not be used to:
   1. Serve as final, definitive quantity requirements. Contractor shall make own count as indicated on Drawings.
   2. Determine proper type or model with arrangement, mounting and accessories applicable.

D. Coordinate installation work of Division 22 with work of other trades to provide a complete and functional system. Generally, the location of sanitary and vent piping take precedence over electrical conduit and cable trays.

1.5 QUALITY ASSURANCE

A. Comply with all State and Local requirements.

1.6 PRODUCT UNLOADING AND HANDLING

A. Unload materials required for completion of the Work.

B. Handle and store materials carefully to prevent damage. Method of rigging and handling shall be subject to the approval of an authorized representative of the equipment Manufacturer whose equipment is being handled.

1.7 TROUBLESHOOTING

A. By Contractor: If, during the start-up or warranty period, mechanical systems operational problems occur for which the root cause is not readily apparent, Contractor shall promptly, through a Subcontractor or other resource designated by Subcontractor, provide diagnostic and investigative services to determine the cause or causes.

B. By Engineer:
   1. At Contractor's request, Engineer will provide the services necessary to determine the cause or causes of the operational problems.
   2. Under the provisions of the General Conditions, Engineer will also provide these services if Contractor fails to respond satisfactorily to operational problems within a reasonable time after written notice from Engineer.
   3. If while working at Contractor's request or under the provisions of the General Conditions, Engineer determines that the problems are due to failure of the Work to comply with the requirements of the Contract Documents, Owner will compensate Engineer for additional services and deduct the amount paid from payment or payments to Contractor.

PART 2 - PRODUCTS

2.1 FABRICATIONS

A. Miscellaneous Structural Steel:
   1. Comply with the requirements of Division 05 Section “Metal Fabrications,” where applicable.
   2. Structural steel work shall be done in accordance with the AISC Specification for Design, Fabrication and Erection of Structural Steel for Buildings, except that allowable stresses shall be reduced 25%.
   3. Where required, high strength structural steel bolting conforming to ASTM Specification A325 and assembled to AISC "Specifications for Assembly of Structural Joints. Using High Strength Steel Bolts" or welding shall be used in place of rivets.
   4. Connections shall be properly designed for the type of connection and the loads to be carried, and shall be subject to Engineer's or Owner's approval.
   5. Welding shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society "Standard Qualification Procedure" to perform the type of work required.

6. Welding techniques shall conform to the American Welding Society "Code for Arc and Gas Welding in Building Construction", Section 4, Workmanship.
7. Finished members shall be true to line and free from twist, bends and open joints.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Character of Work: Installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.

B. Laying Out of Work:
1. Layout piping, equipment and components in accordance with the Contract Documents and the Manufacturer's recommended practice, including provision of adequate space for maintenance. Review layout with Engineer prior to installation.
2. Check drawings of other trades to verify spaces in which work will be installed. Maintain maximum head room and space conditions at all points. Where head room or space conditions appear inadequate, notify Engineer before proceeding with installation.
3. If directed by Engineer, Contractor shall make reasonable modifications in the layout as required to permit proper execution of the Work and to prevent conflict with work of other trades.
4. Work shall be installed so as to be ready for operation, maintenance and repair. Minor deviations from Drawings may be made to accomplish this. Changes shall not be made without approval of Engineer.

3.2 EXCAVATING AND BACKFILLING

A. Comply with the requirements of Division 31 Section "Excavation and Fill for Utilities."

3.3 CODING AND TAGGING

A. Piping:
1. Applied to new piping after installation and painting.
2. Conform to Owner's existing standards or conventions.
3. Markings:
   a. Painted on, 1-inch high black letters.
   b. Color coded band, conforming to ANSI A13.1.
   c. Directional arrow.
4. Place markers at 20-foot centers with at least 1 in each room, and at every change in direction.
5. Plastic coated "Set Mark-Snap-Around" pipe markers manufactured by Seton Name Plate Corp., New Haven, Connecticut; or approved equal, may be used in lieu of painted markers and bands.

3.4 CLEANING AND FINISHING

A. Comply with the requirements of Division 01 Section "Cleaning and Waste Management."

B. Entire installation shall be free from surface oil and grease before work will be considered for final payment.

C. After tests have been made and the system pronounced tight:
1. Clean piping.

D. Final cleaning includes but is not limited to the following:
1. Equipment with Factory Finishes:
   a. Wash factory-finished equipment with mild soap and water and leave in first-class condition, entirely free of stains or streaks.
   b. Do not use abrasive materials. Touch up scratches or other violations of the factory finish paint with matching paint from the equipment Manufacturer prior to cleaning.
2. Clean floor drains and leave free of foreign material.

END OF SECTION 22 05 00

SECTION 22 05 06 – CAST IRON PIPE AND FITTINGS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the basic requirements of all cast iron pipe and fittings. Refer to Division 22 Section "Plumbing Piping and Specialties" for project specific requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Specifications:
      a. A74 - Hub and Spigot Cast Iron Soil Pipe and Fittings.
      b. A888 - Hubless Cast Iron Soil Pipe and Fittings.
      c. C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
      d. C1277 – Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
   2. Cast Iron Soil Pipe Institute (CISPI) Specification:
      a. 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary System.
      b. 310 - CISPI's Patented Joints for Use in Connection with Hubless Cast Iron Sanitary System.
   3. AWWA Standard:
      a. Couplings for Use in Connection with Hubless Cast Iron Pipe and Fittings for Drain, Waste and Vent Piping Applications.
      b. C110 - Gray-Iron and Ductile-Iron Fittings, 3 inches through 48 inches, for water and other liquids.
      c. C111 - Rubber Gasketed Joints for Ductile-Iron Pressure Pipe and Fittings.
      d. C151 - Ductile Iron Pipe Centrifugally Cast in metal Molds or Sand Lined Molds for water or other liquids.
      e. C153 - Ductile Iron Compact Fittings, 3-inch through 24-inch.

1.4 SUBMITTALS

A. Submit in accordance with Division 01 Section "Submittal Procedures."

B. Manufacturer's Literature: For cast iron pipe and fittings and couplings. Includes Manufacturer name, Manufacturer location, dimensions, and details of construction and installation.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the installation of the material.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Requirements: Comply with local code applicable to installation of the material.

PART 2 - PRODUCTS

2.1 HUB AND SPIGOT PIPE AND FITTINGS

A. ASTM A74, Service class.

B. Gaskets:
   1. ASTM C 564.
   2. Elastomeric double seal compression type.

C. All pipe and fittings shall be made in the United States and bear the CISPI trademark.

2.2 HUBLESS PIPE AND FITTINGS

A. ASTM A888 and CISPI 301.

B. Couplings:
   1. ASTM C1277 Couplings.
   2. ASTM C1540 Heavy Duty Couplings.
   3. Corrosion resistant fasteners.
   4. ASTM C564 rubber sleeve with integral, center pipe stop.
   5. Above Ground or Corrosive Soils:
      a. Heavy Duty, Type 304, Stainless Steel Couplings: ASTM A666, Type 304, stainless steel shield; stainless steel bands; and sleeves.
         1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch wide shield with 4 bands.
         2) NPS 5 to NPS 10 (DN 125 to DN 250): 4-inch wide shield with 6 bands.
      b. Heavy Duty, Cast Iron Couplings: ASTM A48, 2 piece, cast iron housing; stainless steel bolts and nuts; and sleeve.
   6. Below Ground (Non-Corrosive Soils):
      a. Heavy Duty, Type 301, Stainless Steel Couplings: ASTM A666, Type 301, stainless steel shield; stainless steel bands; and sleeve.
         1) NPS 1-1/2 to NPS 4 (DN 40 to DN 100): 3-inch wide shield with 4 bands.
         2) NPS 5 to NPS 10 (DN 125 to DN 250): 4-inch wide shield with 6 bands.

C. All pipe and fittings shall be made in the United States and bear the CISPI trademark.

PART 3 - EXECUTION

3.1 ERECTION

A. System shall be installed in accordance with Manufacturer's instructions and Code requirements.

B. Hubless piping shall not be used for pressurized applications.

3.2 JOINTS AND FITTINGS

A. Mitered joints will not be permitted.

B. Joints between CI soil pipe and "DWV" (drain, waste and vent) copper pipe are to be made with calking ferrule for bell and spigot pipe or a compatible adapter for hubless pipe.

C. Pipe and fittings shall be joined by 1 of the following 3 methods:
   1. Calked lead and oakum.
   2. Positive double seal elastomeric compression type gasket.
   3. No hub clamp assembly.

D. Service weight pipe shall be joined with service weight gasket.

E. Use extra heavy gasket with extra heavy pipe.

END OF SECTION 22 05 06

SECTION 22 05 29 – HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all pipe hanging and support systems.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASME - American Society of Mechanical Engineers:
      a. B31.9 - Building Services Piping.
   2. MSS - Manufacturers Standardization Society:
      a. SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture Selection Application and Installation - 2009.
      b. SP-69 - Pipe Hangers and Supports - Selection and Application - 1996.
      c. SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.

1.4 DEFINITIONS

A. Other Terms: As defined in MSS SP-90.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Unless otherwise indicated on Drawings or in these Specifications, this Contractor shall be responsible to design and provide all pipe hangers, supports, restraints, braces, framing, etc., as required to comply with all applicable building codes, ASME B31 and MSS SP-69.

1.6 SUBMITTALS

A. Manufacturer's Literature: For structural steel attachment devices and hangers. Include name of Manufacturer; model number and MSS Type.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The materials of all pipe hanging and supporting elements shall be in accordance with the latest requirements of the ASME Code for Pressure Piping B31.1 and MSS Standard Practice MSS SP-58 and MSS SP-69 except as supplemented or modified by the requirements of these Specifications.

B. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.

C. Special Finishes and Materials:
   1. All ferrous hangers and supports used in the following areas shall be hot dip galvanized unless noted otherwise:
      a. Outside.
      b. In wet or potentially wet areas.

2.2 MANUFACTURERS

A. Acceptable Manufacturers:
1. Elcon.
2. Michigan Hanger.
3. Anvil.
4. Bergen.
5. Hilti.
6. Lindapter.
7. Thybar.
8. Pate.
9. Miro.
10. Roof Products and Systems.
11. A.E.S.
12. MicroMetl.
13. PHD Manufacturing.

2.3 PIPE HANGERS AND SUPPORTS

A. Horizontal Piping Hangers: Unless otherwise indicated and except as specified in piping system Specification sections, install the following types:
1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30 (DN15 to DN750).
2. Carbon or Alloy Steel, Double Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
3. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
4. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
5. Adjustable Swivel Split or Solid Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
6. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN 15 to DN200).
7. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
8. Adjustable Swivel Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
9. Split Pipe Ring With or Without Turnbuckle Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
10. Extension Hinged or 2 Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
11. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).

B. Vertical Piping Clamps: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
2. Carbon or Alloy Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

C. Hanger Rod Attachments: Unless otherwise indicated and except as specified in piping system specification sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Swivel Turnbuckles (MSS Type 15): For use with MSS Type II, split pipe rings.
3. Malleable Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 degree F (49 to 232 degree C) piping installations.

2.4 HANGER RODS

A. Minimum rod diameters for rigid rod hangers shall be as shown in MSS SP-69 Table 4 (Minimum Rod Diameter for Single Rigid Rod Hangers) and as indicated in Part 3 of these Specifications.

B. Hanger rods shall be subject to tensile loading only.

C. Rod material must be compatible with hanger and comply with above. Do not field cut thread on galvanized rod.

D. Do not use perforated strap.

2.5 BUILDING ATTACHMENTS

A. As indicated on the Drawings or in the Specifications.

B. Concrete Attachments:
   1. Provide galvanized finish for all attachments used in wet or potentially wet areas.
   2. Provide stainless steel bolts and nuts in wet and potentially wet areas.
   3. Poured Concrete:
      a. Use cast-in-place inserts or bolted surface mounted attachments, at Contractor's option.
      b. Expansion style anchors are not permitted on piping systems subject to vibration.

C. Horizontal Piping:
   1. Steel W, I, or S shapes: MSS Type 23 clamp with retaining clip, (Anvil Fig. 88, Fig. 89 for non-seismic and Fig. 89X for seismic applications) up to 2-inch; MSS Type 28 (Anvil Fig. 292) or MSS Type 21 (Anvil Fig. 133, 134) above 2-inch.
   2. Steel Channel: MSS Type 20 universal channel clamp.
   3. Concrete: See "B" above.
   4. Timber: Angle bracket and lag screws or as detailed on Drawings.
   5. Steel Z Shapes: Custom attachment required.

D. Vertical Piping:
   1. Concrete: See "B" above.
   2. Timber: Ceiling hanger flange (Anvil Fig. 128R, 153) angle brackets and lag screws, or as detailed on Drawings.

E. In the absence of a Specification for a particular type of attachment, furnish attachments comparable in type and quality to that specified above for a similar situation.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. General Requirements:
   1. The selection of pipe hangers and supports shall be based on the overall design concept of the piping system and any special requirements which may be called for in these Specifications or as indicated on the Drawings.
   2. The selection of hangers or supports will take into consideration the combined weight of the supported systems, including system contents and test water.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification sections.

3.2 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. General:
   1. Adjust all components as required for proper operation and required pipe slope.
   2. Double nut all support rods at hangers.
   3. Location and Routing:
      a. Install Piping as Indicated on the Drawings.
      b. Secure Engineer's approval for all pipe routing changes.
   4. Coordinate with other trades for placement of concrete attachments prior to concrete pouring.
   5. Install all items in accordance with Manufacturer's instructions.

C. Vertical Risers:
   1. Support independently from adjacent hangers on horizontal piping.
   2. Cast Iron Waste, Vent or Drainage Piping:
      a. Support at the base and at each floor level.
      b. Support spacing not to exceed 15-foot centers.

D. Horizontal Runs:
   1. General:
      a. Provide adequate supports for the loads with a factor of safety of at least 5 (400 pounds minimum).
      b. Support spacing not to exceed MSS SP-69 Table 3.
      c. Hanger rod diameter shall not be less than the requirements of MSS SP-69 Table 4.

E. Cast Iron Soil Piping:
   1. The size of hanger components shall be suitable for the O.D. of the pipe to be supported.
   2. Spacing shall comply with MSS SP-69 Table 3.

END OF SECTION 22 05 29

SECTION 22 05 31 – PENETRATIONS FOR PLUMBING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Pipe sleeves.
   2. Prefabricated and site built curb assemblies.
   3. Flashing and sealing of all mechanical openings through weather or waterproofed walls, roofs and floors.
   4. Sealing and finishing of all mechanical openings.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
   1. General Contractor:
      a. Locate and place all sleeved and framed openings as part of constructing the wall and floor surfaces in which the openings occur.
      b. Provide all lintels and required stiffening members for wall and floor openings.
      c. Cut roofing and install flashing for all required openings in proprietary roof membrane systems.
      d. Cut all roof deck openings and provide required framing supports.
   2. Mechanical Subcontractor:
      a. Advise General Contractor of quantity, location and size of all required openings.
      b. Provide all curbs, sleeves, seals, escutcheons and related materials required for finishing, sealing and waterproofing mechanical openings. Furnish all flashing and counterflashing.
      c. Arrange and pay for all openings required after wall, roof and floor construction is complete.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with ASTM D2202 - Test Method for Slump of Sealants.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all premanufactured curbs and sealing assemblies.
   1. Manufacturer's name.
   2. Model number.
   3. Details of construction and installation.
   4. Certified load-bearing data for all curbs.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Codes and Standards: "Architectural Sheet Metal Manual" as published by SMACNA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Prefabricated Stack Sleeve Assemblies:
1. Josam.
2. Wade.
3. Zurn.

B. Pipe Seals and Boots:
1. The Pate Company.
2. Portals Plus, Inc.
3. Roof Products and Systems Corporation.
4. Thunderline Corporation.
5. Thycurb Corporation.

C. Modular Mechanical Seals:
1. Thunderline/Link-Seal.
2. As approved.

D. Backer Rod: Industrial Thermo Polymers, “Standard Backer Rod”.

E. Acoustical Sealant: Pecora, “BA-98”.

F. Expanding Resilient Foam: General Electric, “RTF762.”

2.2 MATERIALS

A. Backer Rod:
1. Extruded round, closed cell, polyethylene foam.
2. Resilient, non-exuding.
3. Density: 2.0 pounds per cubic foot.
4. Tensile Strength: 50 psi.
5. Nonabsorbent to water and gasoline.
6. Suitable for use as a backing for acoustical sealant.
7. Compatible with sealant and approved by sealant Manufacturer.

B. Acoustical Sealant:
1. Nonfire-Rated Penetrations:
a. Non-drying, non-hardening and non-bleeding.
b. Laboratory tested sealant which effectively reduces airborne sound transmission through wall systems.
c. Viscosity: 350,000 to 400,000 (Brookfield No. 65, 10 RPM).
d. Aging: Firm but rubbery, good tack after 50 days conditioned at 160 degrees F.
e. Slump: 0.1 to 0.2 inches in accordance with ASTM D2202.
f. Color: Gray.

C. Packing Material for Penetrations:
1. Glass Fiber or Mineral Fiber:
a. Noncombustible.
b. Resistant to water, mildew, and vermin.
2. Expanding Resilient Foams:
a. Acceptable alternative if manufactured for this purpose.
b. Minimum material density: 60 pounds per cubic foot.

2.3 SLEEVES

A. Materials:
1. 18-Gage Galvanized Steel: For pipe penetrations in non-bearings walls.
2. Schedule 40 Steel Pipe:
a. For all bearing walls.
b. For all floors.
3. Cast Iron Pipe: For all exterior below grade installations.

B. Size All Sleeves:
1. To allow for movement due to expansion.
2. As indicated on the Drawings.

2.4 MANUFACTURED UNITS

A. Stack Sleeves and Flashing Fittings:
1. Provide as required for roof and floor pipe penetrations.
2. Equal to Josam 264xx series products.

B. Exterior Pipe Opening Seals:
1. Compatible with installation conditions.
2. Equal to One of the Following:
a. Pate "Pipe Seal".
b. Portals Plus Model C-126.
3. Link-Seal.

C. Modular Mechanical Seals:
1. Provide modular, mechanical type, consisting of inter-locking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening.
2. The elastomeric element shall be sized and selected in accordance with Manufacturer's recommendations and have the following properties as designated by ASTM:
a. For Standard Service Applications:
1) -40 to +250 degrees F (-40 to +121 degrees C).
2) EPDM = ASTM D2000 M3 BA510.
b. For High Temperature or Fire Seal Applications:
1) -67 to +400 degrees F (-55 to +204 degrees C).
2) Silicone = ASTM D2000 M1GE505.

PART 3 - EXECUTION

3.1 ROOF OPENINGS

A. Piping:
1. As indicated on the Drawings.
2. For Multiple Pipes Through Single Opening:
a. Select sleeve of ample size to accommodate pipes.
b. Prefabricated insulated curbs acceptable.
3. Fill Annulus Opening:
a. Use non-combustible insulation material.
b. Full depth of sleeve.
4. Provide Moisture Protection Using:
a. Elastomeric boot.
b. Metal hood.
c. Flashing fitting.

B. Locate curbs and sleeves a minimum of 12 inches from walls to permit proper flashing.

3.2 FLOOR OPENINGS

A. Use riser sleeve with integral flashing flange and clamp for all waterproof membrane floors.

B. Pipe Penetrations:
   1. Domestic Water, Sewer, Drain and Vent Piping:
      a. Where a pipe passes through a wall, ceiling, or floor slab, cast or grout a steel sleeve into the structure.
      b. Internal diameter of the sleeve: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
      c. After all of the piping is installed in a specific area, check the clearance and correct it, if necessary, to within 1/2-inch (12 mm).
      d. Pack the void full depth with packing material and seal at both ends, 1-inch (25 mm) deep.
      e. In noise-critical walls and floors, pack with sealant backed by foam rod.
      f. Where pipes pass through a masonry wall in sufficient numbers and density that individual pack-and-calk details are not possible, a special isolation detail shall be developed:
         1) Cast pipe sleeves in a block of concrete with the sleeves located a minimum of 2 inches (50 mm) apart.
         2) Block thickness: At least as thick as the surrounding wall construction.
         3) Each sleeve diameter: 2 inches (50 mm) larger than the external diameter of the pipe passing through it.
         4) Build the sleeved block into the wall.
         5) After the pipes are installed, pack and calk voids as indicated above.

3.3 OUTSIDE WALL OPENINGS

A. Pipes:
   1. Pass through sleeves fabricated of Schedule 40 pipe cut 3/8-inch back from face of wall on each side.
   2. Sealed 100% watertight.
   3. Pipes below grade use cast iron sleeves.

3.4 FLOOR SLEEVES IN POTENTIALLY WET AREAS

A. All floors except slabs on grade.

B. Extend sleeves 3 inches above finished floor.

C. Provide poured concrete curb for duct openings as indicated in the Drawings.

3.5 ESCUTCHEONS AND CLOSURE COLLARS

A. Includes ceilings, partitions, floor and walls.

B. Provide Escutcheons for All Piping:
   1. Sized to fit over coverings.
   2. In All Potentially Wet Areas: Stainless steel.
   3. In All Dry Finished Areas: Chrome plated.

END OF SECTION 22 05 31

SECTION 22 05 73 – TESTING AND CLEANING OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes providing testing and cleaning services and the major items listed below:
   1. Provide all pumps, gages, valves and other equipment and material necessary to properly conduct tests and perform cleaning.
   2. Arrange and pay for all costs of utilities and chemicals required for the Work.
   3. Repair and Restore All Work Damaged:
      a. By tests.
      b. By cutting required in connection with the tests.

1.3 SUBMITTALS

A. Flushing and Cleaning:
   1. Submit certificates for all code-required inspections.

B. Pressure Test Reports:
   1. Submit within 1 week after each system pressure test.
   2. List time, date and persons present for the following for each system:
      a. Initial tests.
      b. Final test.
   3. Include report indicating:
      a. Test type and duration.
      b. Initial pressure.
      c. Final pressure.
   4. Indicate that necessary repairs and final tests were satisfactorily completed.

1.4 QUALITY ASSURANCE

A. Comply with all applicable codes.

PART 2 - PRODUCTS

2.1 CLEANING AGENT MANUFACTURERS

A. Aqua-Chem.

B. Aquatrol.

C. Enerco.

D. Nalco.

2.2 MATERIALS

A. Detergents, solvents and other cleaning agents shall be compatible with materials of fabrication of systems where they are used. No cleaning agent shall adversely affect materials or mechanisms in systems and cleaning agents shall be acceptable to equipment manufacturers and the plant environmental coordinator.

B. Detergents, solvents and other cleaning agents shall be compatible with process streams to be handled by systems in which the cleaning agents are used.

C. Owner will provide water for pipe cleaning and flushing. Other cleaning fluids, agents, and equipment shall be provided by Contractor.

D. Provide the necessary temporary equipment required for cleaning and flushing operations.

E. Provide a temporary pump of sufficient head and GPM required to achieve a flushing velocity of at least 10 feet per second.

F. Provide all hose, electrical leads and supply connections for completion of system required to fill, drain and refill of the lines utilizing plant supplied water and power.

PART 3 - EXECUTION

3.1 PIPING SYSTEM PRESSURE TEST

A. General:
1. Perform all tests before piping is painted, covered, concealed or backfilled.
2. Before testing, remove or otherwise protect from damage, control devices, air vents, fixtures, meters, or other parts which are not designated to withstand test pressures.

B. Test Procedures:
1. Water Test:
a. Charge with water to the pressure specified.
b. Exterior Surface of Pipe and Fittings:
1) Show no cracks or other form of leaks.
2) Completely drip dry.

C. Pressure Test Criteria:
1. Test criteria below are minimum requirements. In addition, the requirements of State and Local Codes having jurisdiction shall be met:

Piping System	Type Test	Pressure	Allowable Pressure Drop	Minimum Test Duration
Drainage System	Water	5 psig	0 psi	30 Minutes
Vent System	Water	5 psig	0 psi	30 Minutes

3.2 FLUSHING AND CLEANING PROCEDURES

A. Preinstallation Cleaning:
1. Before installation, unless otherwise specified, piping shall be cleaned as follows:
a. Hammer, brush, scrub with soapy rags, to loosen sand, dirt, or scale when necessary. Remove excess grease and oil from exterior surface.
b. Blow with air, or flush with clean water, and inspect before erection.
c. Pipe cleaned and stored before installation shall be dried and ends sealed with a rigid plug or flange protector and tape.
d. Physical cleaning procedures shall not damage materials or mar surfaces of such materials. Hammering shall not be used on cast iron pipe.

B. System Protection:
1. Protect piping and equipment against overpressure and hydraulic shock during flushing and draining procedures.
2. Install high point vents and low point drains required to remove trapped air and to drain flushing liquid.

END OF SECTION 22 05 73

SECTION 22 10 00 – PLUMBING PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all materials, labor, equipment, supervision, fees, and services incidental to proper completion of all plumbing system work:
   1. Interior waste and vent piping to 5'-0" outside building.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ANSI/ASME Standards:
      a. A112.21.1 - Floor Drains.
      b. A112.36.2M - Cleanouts.
   2. ASSE (American Society of Sanitary Engineering) Standards:
      a. 1072 – Performance Requirements for Barrier Type Trap Seal Protection for Floor Drains.
   3. ASTM Standards:
      a. A74 - Cast Iron Soil Pipe and Fittings.
      b. A181 - Carbon Steel Forgings for General Purpose Piping.
      c. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all products required in Part 2 of this Section:
   1. Required Information:
      a. General:
         1) Name of Manufacturer.
         2) Model number.
         3) Dimensions.
         4) Details of construction and installation.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements: All state and local codes and ordinances shall have jurisdiction.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS

A. Comply with the requirements of Division 22 Section “Cast Iron Pipe and Fittings for Plumbing.”

B. Refer to schedules in Part 3 of this Specification for specific applications of pipe materials to plumbing systems.

C. Refer to Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment” and the schedule in Part 3 of this Section for Hanger and Support Requirements for Plumbing System Piping.

2.2 TRAP SEALS

A. Floor Drain Trap Seals:
   1. For applications with infrequent drain usage:
      a. Provide inline drain trap seal, SureSeal Waterless Inline Drain Trap Seal. Green Drain Model GD Inline Drain Trap.
      b. Must comply with ASSE 1072.
   2. Barrier-type:
      a. Installed in accordance with Manufacturer's instructions. Must comply with ASSE 1072.
      b. Manufacturer: Green Drain, IPS Corporation, Jay R, Smith, Rector Seal, Zurn.

2.3 CLEANOUTS

A. Description:
   1. Furnish and install cleanouts where indicated on drawings in accordance with the following table.
   2. Series floor cleanout with NH spigot outlet or ty-seal outlet connection, threaded adjustable housing, flanged ferrule with tapered brass plug and round or square nickel brass or ductile iron vandal resistant secured top for floor finishes as follows:

Location	Wade Number
Unfinished Concrete (Scoriated XH Di Top)	W-6000-Z
Exterior Areas (Scoriated XH Di Top)	W-6000-Z
Vertical rough piping (exposed)	W-8560-E

B. Manufacturer: Wade, Zurn, Josam, Smith, MI-FAB.

2.4 FLOOR DRAINS

A. Furnish and install floor drains at low point of sloped floor or at elevations indicated on the Drawings in accordance with the following.
   1. Provide 4-inch deep seal traps on floor drains.
   2. Provide tapping for connection of trap seal primer line on floor drains.

B. Description:
   1. Floor Drains:
      a. FD-1: See schedule on Drawings.

C. Manufacturer: Wade, Josam, Zurn, Smith, MI-FAB, Watts.

PART 3 - EXECUTION

3.1 BUILDING SANITARY DRAINAGE SYSTEM

A. Description: Furnish and install the entire building sanitary drainage system as indicated on the Drawings. System includes, but is not necessarily limited to, the following items: Waste and vent piping for all plumbing, fixtures requiring same, floor drains, cleanouts.

B. Material:
   1. Above and below ground piping as defined in Part 2 of this Section.
   2. Drains and cleanouts as defined in Part 2 of this Section.

C. Installation:
   1. General runs of sanitary sewer are indicated on Drawings diagrammatically and every bend, offset, etc., is not necessarily indicated, all of which must be installed to properly drain all stacks, fixtures, vents, etc.
   2. Run horizontal waste lines at a minimum slope of 1/4-inch per foot for pipes less than 3 inches in diameter and 1/8-inch per foot for lines 3 inches and larger, unless indicated otherwise.
   3. Connections between mains and laterals shall be made with wyes and 1/8 bends.

4. Changes in direction shall be with long radius ells except in stacks where sanitary tees and short radius 1/4 bends may be used in changes from horizontal to vertical.
5. Flash all vent stacks at the roof.
6. Cleanouts shall be installed where required by code and as indicated on the Drawings and specified herein. They shall be accessibly located, set flush with finish surface or finish grade, and shall be same nominal pipe size as line served, but no larger than 4 inches.
7. Cleanouts indicated for lines outside of building shall be installed with a Y connection and a 4 degree elbow extending to grade with bell set in concrete collar not less than 12 inches square and 12 inches thick.
8. Furnish and install stack base fittings at the base of each riser set on a concrete or brick base on firm soil. All vertical risers shall be supported at floors.
9. Pitch vent lines to gravity drain to waste pipe.

3.2 CLEANING, TESTING, CHLORINATION

A. As piping material is erected, the inside of all piping shall be thoroughly cleaned of foreign material. Flush and test piping before operation in accordance with Division 22 Section “Testing and Cleaning of Plumbing Systems.”

3.3 SCHEDULES

Sanitary				
System	Schedule	Material	Specifications	Remarks
Underground				
Sanitary: Minimum size 3 inches unless noted otherwise				
	S.V.	C.I.	ASTM A74	Bell & Spigot with Elastomeric Gasket or Lead & Oakum
	S.V.	C.I.	ASTM C564, A888	No Hub with Heavy Duty Couplings
Above Ground				
Sanitary	S.V.	C.I.	ASTM A74	Bell & Spigot with Elastomeric Compressive Gasket. Lead & Oakum
	S.V.	C.I.	ASTM C564, A888	No Hub

END OF SECTION 22 10 00

SECTION 23 01 00 – OPERATION AND MAINTENANCE OF HVAC SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to individual Division 23 sections for additional equipment specific Operations and Maintenance Manual requirements.

1.2 SUMMARY

A. This Section includes preparing and furnishing an operating and maintenance manual for mechanical equipment.

1.3 DESCRIPTION

A. Compile an Operating and Maintenance Manual:
   1. For all building mechanical systems and major equipment items.
   2. Including, but not necessarily limited to:
      a. Installing company's name, address, telephone number and name of job supervisor.
      b. Maintenance and operating booklets (as supplied by the equipment Manufacturer) for each item or representative type item installed.
      c. Equipment information forms for each equipment piece.
   3. Each equipment information form include all applicable items of the following:
      a. Type of unit.
      b. Manufacturer's name.
      c. Equipment service area.
      d. Motor and Drive Information:
         1) HP.
         2) Voltage.
         3) Phase.
      e. Lubrication Information:
         1) Recommended service interval.
         2) Lubricant application points.
         3) Recommended lubricant type.
      f. Recommended cleaning procedures and intervals.

B. Prepare Information Packets:
   1. Attach to each major piece of equipment in a string tie envelope labeled with the equipment's designation in large print.
   2. Information Required:
      a. A copy of the equipment information form as defined above.
      b. A temperature control written operation sequence.
      c. A maintenance checklist form with equipment identification information and listing all relevant maintenance procedures in a column format to accommodate date entries.

1.4 SUBMITTALS

A. Three hard copies of Operating and Maintenance Manual.

B. PDF Electronic File: Include a complete electronically linked operation and maintenance directory.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION 23 01 00

SECTION 23 05 00 – GENERAL HVAC PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes specifying the general requirements for execution of that portion of the Work defined in Division 23 of these Specifications and as indicated on the Drawings:
   1. Major items include, but are not necessarily limited to:
      a. Cutting and patching.
      b. Support steel.
      c. HVAC equipment, including drives.
      d. Ductwork.
      e. Labor, materials, equipment, tools, supervision, and start-up services.
      f. Mechanical systems testing, adjusting, and balancing.
      g. Instructions to Owner regarding operation.
      h. Incidental and related items necessary to a complete and functionally operational installation of the Work.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
   1. General Contractor:
      a. Refer to Division 01 Section “Cutting and Patching.”
   2. Mechanical Subcontractor:
      a. Refer to Division 01 Section “Cutting and Patching.”
      b. Furnish location, size, and quantity of openings to Contractor before construction of new walls, ceilings, and floors.
      c. Provide miscellaneous structural steel required in connection with support of the Work of Division 23.
      d. Perform final cleaning of mechanical systems and equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of Division 23 shall comply with the following:
   1. ASTM: A325 - Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
   2. Michigan:
      a. Building Code of 2015.
      b. Mechanical Code of 2021.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Construction details, components, accessories, sizes and model numbers indicated on the Drawings or in these specifications are used to indicate minimum levels of quality and coordination requirements.

B. Design and layout, including clearances and service access, are based on Manufacturer, model and components as scheduled or otherwise indicated on the Drawings. Other listed approved Manufacturer's components and equipment are acceptable provided the following conditions are satisfied:
   1. Meet minimum requirements listed in specifications or on Drawings, be compatible with facility and intended use, and meet requirements for a functional system.
   2. Present to Engineer documentation verifying that all the above conditions are satisfied at least 10 days prior to bid receipt date.

3. Coordinate and pay for all changes resulting from the use of alternate equipment and components:
   a. Coordinate and pay for all resulting work in other trades, including redesign efforts.
   b. Make all system changes required in utilizing alternate equipment. Changes must reflect building conditions, ceiling spaces, structure locations.
   c. Obtain Engineer's prior approval for all changes to layout, clearances, components, and service access proposed.

C. Drawings:
   1. Are diagrammatic and indicate general arrangement of systems and work included.
   2. Do not necessarily indicate every required fitting, duct, transition, mounting support and access panel.
   3. Shall not be scaled for measurement or installation location.
   4. Shall not serve as Shop Drawings.

D. Schedules and model numbers shall not be used to:
   1. Serve as final, definitive quantity requirements. Contractor shall make own count as indicated on Drawings.
   2. Determine proper type or model with arrangement, mounting and accessories applicable.

E. Coordinate installation work of Division 23 with work of other trades to provide a complete and functional system. Generally, the location of ductwork, sanitary, and vent piping take precedence over electrical conduit and cable trays.

1.5 PRODUCT UNLOADING AND HANDLING

A. Unload equipment and materials required for completion of the Work.

B. Handle and store equipment and materials carefully to prevent damage. Method of rigging and handling shall be subject to the approval of an authorized representative of the equipment Manufacturer whose equipment is being handled.

1.6 TROUBLESHOOTING

A. By Contractor: If, during the start-up or warranty period, mechanical systems operational problems occur for which the root cause is not readily apparent, Contractor shall promptly, through a Subcontractor or other resource designated by Subcontractor, provide diagnostic and investigative services to determine the cause or causes.

B. By Engineer:
   1. At Contractor's request, Engineer will provide the services necessary to determine the cause or causes of the operational problems.
   2. Under the provisions of the General Conditions, Engineer will also provide these services if Contractor fails to respond satisfactorily to operational problems within a reasonable time after written notice from Engineer.
   3. If while working at Contractor's request or under the provisions of the General Conditions, Engineer determines that the problems are due to failure of the Work to comply with the requirements of the Contract Documents, Owner will compensate Engineer for additional services and deduct the amount paid from payment or payments to Contractor.

1.7 MAINTENANCE

A. Special Tools: Where special tools are required for operation, furnish these to Owner.

B. Loose and Detachable Parts:
   1. Retain loose and small detachable parts of the apparatus and equipment furnished until the completion of the Work.
   2. Turn over these parts to Owner.

C. Permanent Heating and Cooling Equipment:
   1. Notify Engineer when installed and proposed to be used to heat building interior.
   2. If the HVAC units and ductwork are found to be dirty at the time of Owner occupancy or at any time, the Contractor will clean the units to the Owner and Engineer's satisfaction. The cleaning may include but not be limited to the following:
      a. Steam cleaning of coils.
      b. Vacuum cleaning of ductwork and/or interior of unit.
      c. Brushing and vacuuming of fan wheels.

1.8 SUBSTITUTIONS

A. The Base Bid shall be based on equipment as specified. Where items are mentioned thusly, "may be furnished at the Contractor's option", the Contractor may use any one of the items named for their Base Bid. Proposals for substitutions are welcomed, but must be noted separately from the Base Bid and applied for in writing at Bid submittal.

B. Where the Contractor furnishes equipment or material specified as equal or which is accepted as a substitution, they are responsible for all modifications required for their work, and work of all other trades to install the equipment and ensure performance as originally specified.

C. Equipment and materials furnished as equal or as a substitution must be equal in quality, design, features, performances, arrangement, and appearance to that specified as standard.

PART 2 - PRODUCTS

2.1 FABRICATIONS

A. Miscellaneous Structural Steel:
   1. Comply with the requirements of Division 05 Section “Metal Fabrications,” where applicable.
   2. Structural steel work shall be done in accordance with the AISC Specification for Design, Fabrication and Erection of Structural Steel for Buildings, except that allowable stresses shall be reduced 25%.
   3. Where required, high strength structural steel bolting conforming to ASTM Specification A325 and assembled to AISC "Specifications for Assembly of Structural Joints. Using High Strength Steel Bolts" or welding shall be used in place of rivets.
   4. Connections shall be properly designed for the type of connection and the loads to be carried, and shall be subject to Engineer's or Owner's approval.
   5. Welding shall be done by operators who have been previously qualified by tests as prescribed in the American Welding Society "Standard Qualification Procedure" to perform the type of work required.
   6. Welding techniques shall conform to the American Welding Society "Code for Arc and Gas Welding in Building Construction", Section 4, Workmanship.
   7. Finished members shall be true to line and free from twist, bends and open joints.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Character of Work: Installation shall be executed in a workmanlike manner and shall present a neat mechanical appearance when completed.

B. Laying Out of Work:
   1. Layout equipment and components in accordance with the Contract Documents and the Manufacturer’s recommended practice, including provision of adequate space for maintenance. Review layout with Engineer prior to installation.
   2. Check drawings of other trades to verify spaces in which work will be installed. Maintain maximum head room and space conditions at all points. Where head room or space conditions appear inadequate, notify Engineer before proceeding with installation.

3. If directed by Engineer, Contractor shall make reasonable modifications in the layout as required to permit proper execution of the Work and to prevent conflict with work of other trades.
4. Work shall be installed so as to be ready for operation, maintenance and repair. Minor deviations from Drawings may be made to accomplish this. Changes shall not be made without approval of Engineer.

3.2 CODING AND TAGGING

A. Equipment:
   1. Provide for:
      a. Each exhaust fan and unit heater.
      b. Labeled with its tag name/number as given on the Drawings.
      c. Use 2-inch high stenciled painted lettering.
   2. Similarly label control components associated with the above named equipment items.

3.3 START-UP

A. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.4 ADJUSTING

A. Adjust and align equipment for smooth operation:
   1. Plumb true and with parts in proper position and alignment.
   2. Rotating parts shall turn freely and in the correct direction.
   3. Flexible couplings shall be checked for alignment subject to Owner's approval.
   4. Follow Manufacturer's instructions.

B. The work of installation shall be executed in conformity with the best practice, so as to contribute to efficiency of operation, minimum noise or vibration, minimum maintenance, accessibility and sightlines.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Services:
   1. Provide when required by individual Section.
   2. Provide the following services except where indicated otherwise in individual Sections:
      a. Inspect, check and approve system installation.
      b. Supervise system start-up.
      c. Provide written report indicating that system:
         1) Has been properly installed and lubricated.
         2) Is in accurate alignment.
         3) Is free from undue stress imposed by connecting lines or anchor bolts.
         4) Has been satisfactorily operated under full load conditions.
      d. Demonstrate operation of system to Owner's personnel.
      e. Instruct Owner's personnel on operation and maintenance of system.

B. Performance Test:
   1. Test the entire Work, including all of its individual systems for 2 weeks before final payment will be made.
   2. Every phase of heating and ventilating plant shall be operated separately, or in conjunction one with the other to demonstrate to Engineer the ability of the plant to meet capacity and performance requirements while maintaining design condition, in accordance with the true intent and purpose of these Specifications.
   3. If a part of the Work or equipment does not meet Specifications:
      a. Correct the situation.
      b. Obtain approval of Engineer before final payment is made.
   4. Provide the personnel and bear costs for correcting malfunctions.
   5. Owner will provide operating personnel and utilities.
   6. Air systems balancing shall be completed prior to performance testing.

C. Comply with the requirements of Division 01 Section “Starting and Adjusting.”

3.6 CLEANING AND FINISHING

A. Comply with the requirements of Division 01 Section “Cleaning and Waste Management.”

B. Entire installation shall be free from surface oil and grease before work will be considered for final payment.

C. After tests have been made and the system pronounced tight:
   1. Clean piping and equipment.
   2. Lubricate bearings.

D. Final cleaning includes but is not limited to the following:
   1. Equipment with Factory Finishes:
      a. Wash factory-finished equipment with mild soap and water and leave in first-class condition, entirely free of stains or streaks.
      b. Do not use abrasive materials.
      c. Touch up scratches or other violations of the factory finish paint with matching paint from the equipment Manufacturer.

END OF SECTION 23 05 00

SECTION 23 05 13 – COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all electric motors required for Division 23 specified equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA - National Electrical Manufacturers Association - Standards and publications governing the following performance criteria:
      a. Frame design.
      b. Torque.
      c. Enclosures.
      d. Dimensions.
      e. Power supply and voltages.
      f. Locked rotor KVA per horsepower.
      g. Service factor.
      h. Sound power levels.
   2. NFPA 70 - National Electrical Code.
   3. ASHRAE 90.1 – 2019 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings, with state amendments.

1.4 SUBMITTALS

A. Manufacturer's Literature:
   1. All polyphase motors.
   2. All motors 3 horsepower (name plate) and larger.
   3. All Motors:
      a. Name and manufacturer.
      b. Type and model.
      c. Rated size.
      d. Type of bearings.
      e. Weight.
      f. AFBMA Rating
   4. Lubrication and maintenance instructions.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacture of electric motors and their accessories, with minimum 3 years documented product development, testing, and manufacturing experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored onsite from weather and moisture by maintaining factory covers and suitable weatherproof covering.

B. For extended outdoor storage, remove motors from equipment and store separately in a protected area.

1.7 WARRANTY

A. Provide 2 year Manufacturer's warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Reliance.

B. Magnetek.

C. Baldor.

D. Lincoln Electric.

E. Subject to compliance with specifications, motors drawing less than 250 watts and intended for intermittent service may be supplied by an alternate Manufacturer commonly used by the equipment Manufacturer.

2.2 SPEED (EXCEPT WHERE NOTED OTHERWISE)

A. 1,800 rpm.

B. Constant speed.

2.3 CONSTRUCTION

A. Designed for continuous operation in 40 degree C environment, Class B insulation. Motors interconnected with a variable frequency drive shall be provided with Class F insulation and shall be inverter duty rated, and shall be outfitted with shaft grounding kit or isolated bearings.

B. All copper windings with a minimum service factor of 1.15 for totally enclosed, fan-cooled (TEFC) and 1.25 for open, drip-proof (ODP) motors.

C. NEMA frame, arrangement, and design as required for the specific application.

D. Permanently lubricated unless specifically noted otherwise.

E. Comply with all requirements for UL approval and labeling for specific hazard classification where explosion-proof and severe duty motors are indicated.

F. Provide a visible stainless steel nameplate indicating:
   1. Motor horsepower.
   2. Voltage.
   3. Phase.
   4. Cycles.
   5. RPM.
   6. Full load amps.
   7. Locked rotor amps.
   8. Frame size.
   9. Manufacturer's name and model number.
   10. Service factor.
   11. Power factor.
   12. Efficiency: Nameplate motor efficiency shall be identified in accordance with NEMA and ASHRAE 90.1 standards.

G. Except as specifically noted, all motors shall be high efficiency as listed in ASHRAE 90.1 for all motors 1 horsepower and larger: All efficiency ratings are to be as tested in accordance with IEEE Spec. 112, Method B.

H. Electrical Connection: Conduit connection boxes, threaded for conduit. For fractional horsepower motors where connection is made directly, provide screwed conduit connection in end frame.

I. Variable frequency drive units and motors shall be matched for proper operating characteristics.

2.4 VOLTAGE AND MOTOR TYPE

A. Special conditions and voltage are noted on the Drawings.

B. Electronically Commutated (EC) Motor:
1. Specifically designed for fan applications.
2. Permanently lubricated with heavy duty ball bearings to match fan load and prewired to specific voltage and phase.
3. Internal motor circuitry shall convert AC power supplied to fan to DC power for motor operation.
4. Speed controllable down to 20% of full speed (80% turndown).
5. Minimum 85% efficient at all speeds

C. Single Phase Power - Split Phase Motors:
1. Starting Torque: Less than 150% of full load torque.
2. Starting Current: Up to 7 times full load current.
3. Breakdown Torque: Approximately 200% of full load torque.

D. Single Phase Power - Permanent-Split Capacitor Motors:
1. Starting Torque: Exceeding 1/4 of full load torque.
2. Starting Current: Up to 6 times full load current.
3. Multiple Speed: Through tapped windings.

E. Single Phase Power - Capacitor Start Motors:
1. Starting Torque: Three times full load torque.
2. Starting Current: Less than 5 times full load current.
3. Pull-Up Torque: Up to 350% of full load torque.
4. Breakdown Torque: Approximately 250% of full load torque.
5. Motors: Capacitor in series with starting winding; capacitor-start/capacitor-run motors shall have two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. 3-Phase Power - Squirrel Cage Motors:
1. Starting Torque: One to one and one-half times full load torque.
2. Starting Current: Six times full load current.
3. Power output, locked rotor torque, breakdown or pullout torque: NEMA Design B characteristics.
4. Design, construction, testing, and performance: Conform to ANSI/NEMA MG 1 for Design B motors.
5. Insulation System: NEMA Class B or better.
6. Motor Frames: NEMA standard T-frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
7. Bearings:
   a. Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 20,000 hours.
   b. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension.
   c. Stamp bearing sizes on nameplate.
8. Sound Power Levels: To ANSI/NEMA MG 1, 75 dBA SPL at 3 feet maximum.
9. Nominal Power Factor: Meet or exceed values in Schedules at full load and rated voltage when tested in accordance with ANSI/IEEE 112.

2.5 RATINGS

A. Motors shall meet NEMA standards and be capable of operating at rated load with a voltage variation of ±10%, a variable of ±5% in rated frequency, or a combined variation of 10% without damage to the motor.

B. Motors shall be selected for the type of service involved and shall be selected at a minimum of 15% above the required rating of the equipment served. (Does not include service factor.)

2.6 THERMAL OVERLOADS

A. Provide built-in thermal overloads on all fractional horsepower motors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All materials and equipment shall be installed in accordance with Manufacturer's recommended installation methods for obtaining conformance with the Contract Documents.

B. Alignment of all motors, factory coupled or mounted, and all motors field coupled and mounted, shall be rechecked after all connections have been made and after 48 hours of operation in designed service.

C. Verify the voltage characteristics of each motor prior to ordering.

D. Verify the correct wire connections and rotation of equipment by "bumping" motor after wiring.

E. Confirm voltage imbalance on 3-phase motors is less than 2%.

3.2 APPLICATION: Except as specifically indicated, motors shall be selected as follows:

A. Shaded pole motors are not acceptable.

B. Phase, except where noted otherwise:
   1. Less than 1/2 HP: Single-phase.
   2. 1/2 HP and Larger: Three-phase.

C. Single Phase Starting:
   1. 1/8 HP and Less: Split phase or permanent split capacitor.
   2. Greater than 1/8 HP: Capacitor start.

D. Enclosure:
   1. Totally enclosed fan-cooled (TEFC) for all motors located outside, in wet areas, in mechanical rooms, or elsewhere as indicated.
   2. Open drip-proof (ODP) for motors located elsewhere, in a clean, dry environment.

END OF SECTION 23 05 13

SECTION 23 05 29 – HANGERS AND SUPPORTS FOR HVAC DUCTWORK AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all pipe hanging and support systems.

B. Refer to Division 23 Section “Metal Ducts” for duct hanging requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. MSS - Manufacturers Standardization Society:
      a. SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture.
      b. SP-69 - Pipe Hangers and Supports - Selection and Application - 1996.
      c. SP-90 - Guidelines on Terminology for Pipe Hangers and Supports.

1.4 DEFINITIONS

A. Other Terms: As defined in MSS SP-90.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. The materials of all pipe hanging and supporting elements shall be in accordance with the latest requirements of the ASME Code for Pressure Piping B31.1 and MSS Standard Practice MSS SP-58 and MSS SP-69 except as supplemented or modified by the requirements of these Specifications.

B. The material in contact with the pipe shall be compatible with the piping material so that neither shall have a deteriorating action on the other.

C. Special Finishes and Materials:
   1. All ferrous hangers and supports used in the following areas shall be hot dip galvanized unless noted otherwise:
      a. Outside.
      b. In wet or potentially wet areas.

2.2 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Elcon.
   2. Michigan Hanger.
   3. Anvil.
   4. Bergen.
   5. Hilti.
   6. Lindapter.
   7. Thybar.
   8. Pate.
   9. Miro.
   10. Roof Products and Systems.

11. A.E.S.
12. MicroMetl.
13. PHD Manufacturing.

2.3 HANGER RODS

A. Minimum rod diameters for rigid rod hangers shall be as shown in MSS SP-69 Table 4 (Minimum Rod Diameter for Single Rigid Rod Hangers) and as indicated in Part 3 of these Specifications.

B. Hanger rods shall be subject to tensile loading only.

C. Rod material must be compatible with hanger and comply with above. Do not field cut thread on galvanized rod.

D. Do not use perforated strap.

2.4 BUILDING ATTACHMENTS

A. As indicated on the Drawings or in the Specifications.

B. Concrete Attachments:
   1. Provide galvanized finish for all attachments used in wet or potentially wet areas.
   2. Provide stainless steel bolts and nuts in wet and potentially wet areas.
   3. Poured Concrete:
      a. Use cast-in-place inserts or bolted surface mounted attachments, at Contractor's option.
      b. Expansion style anchors are not permitted on piping systems subject to vibration.

C. In the absence of a Specification for a particular type of attachment, furnish attachments comparable in type and quality to that specified above for a similar situation.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

A. General Requirements:
   1. The selection of hangers and supports shall be based on the overall design concept of the system and any special requirements which may be called for in these Specifications or as indicated on the Drawings. The support systems shall provide for, and control, the free or intended movement of the system including its movement in relation to that of the connected equipment. They shall prevent excess stress resulting from the transfer of weight being introduced into the system or connected equipment.
   2. The selection of hangers and supports shall be made to provide the system with the degree of control that its operating characteristics require. Design hangers and supports to prevent sway and intendent movement.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification sections.

END OF SECTION 23 05 29

SECTION 23 05 31 – PENETRATIONS FOR HVAC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Prefabricated and site built curb assemblies.
   2. Flashing and sealing of all mechanical openings through weather or waterproofed walls and roofs.
   3. Sealing and finishing of all mechanical openings.

B. Division of Work: In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
   1. General Contractor:
      a. Locate and place all framed openings as part of constructing the wall surfaces in which the openings occur.
      b. Provide all lintels and required stiffening members for wall openings.
      c. Cut roofing and install flashing for all required openings in proprietary roof membrane systems.
      d. Cut all roof deck openings and provide required framing supports.
   2. Mechanical Subcontractor:
      a. Advise General Contractor of quantity, location and size of all required openings.
      b. Provide all curbs, sleeves, seals, and related materials required for finishing, sealing and waterproofing mechanical openings. Furnish all flashing and counterflashing.
      c. Arrange and pay for all openings required after wall, roof and floor construction is complete.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with ASTM D2202 - Test Method for Slump of Sealants.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all premanufactured curbs and sealing assemblies.
   1. Manufacturer's name.
   2. Model number.
   3. Details of construction and installation.
   4. Certified load-bearing data for all curbs.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Codes and Standards: "Architectural Sheet Metal Manual" as published by SMACNA.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Backer Rod: Industrial Thermo Polymers, “Standard Backer Rod”.

B. Acoustical Sealant: Pecora, “BA-98”.

C. Expanding Resilient Foam: General Electric, “RTF762.”

2.2 MATERIALS

A. Backer Rod:
1. Extruded round, closed cell, polyethylene foam.
2. Resilient, non-exuding.
3. Density: 2.0 pounds per cubic foot.
4. Tensile Strength: 50 psi.
5. Nonabsorbent to water and gasoline.
6. Suitable for use as a backing for acoustical sealant.
7. Compatible with sealant and approved by sealant Manufacturer.

B. Acoustical Sealant: Nonfire-Rated Penetrations:
1. Non-drying, non-hardening and non-bleeding.
2. Laboratory tested sealant which effectively reduces airborne sound transmission through wall systems.
3. Viscosity: 350,000 to 400,000 (Brookfield No. 65, 10 RPM).
4. Aging: Firm but rubbery, good tack after 50 days conditioned at 160 degrees F.
5. Slump: 0.1 to 0.2 inches in accordance with ASTM D2202.
6. Color: Gray.

C. Packing Material for Penetrations:
1. Glass Fiber or Mineral Fiber:
   a. Noncombustible.
   b. Resistant to water, mildew, and vermin.
2. Expanding Resilient Foams:
   a. Acceptable alternative if manufactured for this purpose.
   b. Minimum material density: 60 pounds per cubic foot.

2.3 MANUFACTURED UNITS

A. Structural Roof Curbs:
1. Frames:
   a. Material: ASTM A653 G90 hot dipped galvanized steel. Minimum 18 gage or heavier, as engineered by Manufacturer.
   b. Corners: Mitered and welded (welds are micro sealed and prime painted after fabrication). Bolted connections are not accepted.
   c. Base Plates: Integral to frame and welded.
   d. Internally reinforced with galvanized 1-inch x 1-inch angles for curbs exceeding 3-foot length. Reinforce internal bulkhead at equipment curbs to support lateral loads.
   e. Wood Nailers: Factory installed, decay resistant. Size and width as suitable for support of items installed on curbs and perimeter of roof deck.
2. Curb Height:
   a. Minimum 18 inches above finished roof surface.
   b. Select curb height so that top of curb is at least 18 inches above finished roof surface with base set on roof structure under the roof decking.
3. Construct curbs to match roof slope with plumb and level top surface for mounting mechanical equipment.
4. Gasketing: 1/4-inch thick, 1-inch wide under all units.
5. Counterflashing: 16 gage galvanized steel.
6. Insulation: Minimum 1-1/2-inch, 3-pound density fiberglass insulation.
7. Curb assembly shall be installed under metal roof deck. Perimeter steel roof deck shall be supported by structural curb assembly. Structural curb bottom flange shall be a minimum width of 2 inches to support roof deck. Steel clips shall be provided where roof deck flutes do not contact bottom flange of structural curb, to prevent crushing roof deck.
8. Non-canted style.
9. Curbs for fans and similar mechanical equipment items are furnished by equipment Supplier unless specified otherwise.

PART 3 - EXECUTION

3.1 ROOF OPENINGS

A. Ducts:
   1. Pass through prefabricated curbs.
   2. Curb Counterflashing:
      a. Provide formed galvanized sheet metal in accordance with Division 07 Section “Sheet Metal Flashing and Trim.”
      b. Solder or pop-rivet with mastic to the duct and extended over and down the top of the curbs for a minimum distance of 2 inches.
      c. Secure to the sides of the wood strips with corrosion-protected lag screws and washers 12 inches on center.

B. Locate curbs a minimum of 12 inches from walls to permit proper flashing.

3.2 OUTSIDE WALL OPENINGS

A. Ducts:
   1. Pass through openings provided by Contractor.
   2. Size opening to allow approximately 1-inch clearance at all duct or duct covering surfaces.
   3. Provide sheet metal closures, insulation, calking, flashing and drip edges.
   4. Install to ensure 100% weatherproof construction.

3.3 ESCUTCHEONS AND CLOSURE COLLARS

A. Includes penetrations of ceilings and walls.

B. Provide Sheet Metal Closure Collar for all Ductwork:
   1. Fit snugly around duct or covering, and surface penetrated without contact.
   2. Attach with approved fasteners 6-inch centers maximum spacing.
   3. Fabricate with minimum 4-inch face.

END OF SECTION 23 05 31

SECTION 23 05 93 – TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes a description of the mechanical system testing, adjusting and balancing (TAB) scope of services. The following systems shall be included in the testing, adjusting, and balancing process:
   1. Electric heating systems.
   2. Exhaust systems.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor shall be responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. Mechanical Subcontractor:
         1) Provide related work as specified herein to support the mechanical systems TAB work being performed by TAB engineer.
         2) Provide access to all balancing devices.
         3) Perform system start-up functions.
         4) Correct all mechanical system deficiencies identified by TAB engineer.
      b. TAB Engineer:
         1) Provide timely notice to mechanical Subcontractor of all incomplete work and deficiencies which prevent proper performance of test and balance work.
         2) Test, adjust and balance all air systems and prepare final report.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. Sheet Metal and Air Conditioning Contractor's Association (SMACNA) publications:
      a. Procedural Standards for Testing, Adjusting, and Balancing of environmental systems.
      b. Procedural Standards for Measuring Sound of Vibration.
      c. Testing, Adjusting, Balancing Manual for Technicians.
   2. Associated Air Balance Council (AABC): National Standards for Total System Balance, 2002 Edition.
   3. National Environmental Balancing Bureau (NEBB): Procedural standards for testing, adjusting, and balancing of environmental systems.
   4. Testing, Adjusting, and Balancing Bureau (TABB): TAB Procedural Guide.

1.4 DEFINITIONS

A. Proper Performance Characteristics:
   1. In accordance with design intent, acceptable energy efficiency and Manufacturer's recommendations.
   2. Providing acceptable thermal and acoustical performance in all service areas.
   3. As directed by Engineer.

B. TAB Engineer: An individual, firm, or corporation whose primary work is testing, adjusting, and balancing environmental systems working under a direct contract to the Contractor.

1.5 SUBMITTALS

A. Preliminary TAB Submittal:
   1. Prior to final inspection.
   2. A pdf file to Engineer.
   3. A pdf file to mechanical commissioning authority: As soon as possible after balancing work to facilitate spotchecking.

B. Final Submittal: A pdf file to Engineer.

C. The TAB report shall include, but not necessarily be limited to, the following general items:
   1. Summary remarks regarding problems.
   2. Initial, interim and final performance test data.
   3. Description of test procedures and equipment used.
   4. Systems performance data sheets shall include design conditions, installed equipment information, and field test data for:
      a. Air Systems:
         1) Design Conditions:
            a) Air capacity.
            b) System total static pressure drops and profiles of all air handling systems.
            c) Motor horsepowers and design brake horsepowers.
            d) Fan speeds.
            e) Fan curves or fan rating tables showing design conditions.
         2) Installed Equipment:
            a) Equipment Manufacturer.
            b) Equipment model numbers, sizes, types, etc.
            c) Motor types, sizes, and characteristics.
            d) Heater and starter types, sizes, and characteristics.
            e) Drive types, sizes, and speed range.
            f) Equipment ratings if different from design.
         3) Field Test Data - Initial and Final Test Readings For:
            a) Air capacities.
            b) Static pressures through units and unit components.
            c) Equipment speeds.
            d) Motor operating voltages and amperages.
            e) Brake horsepower.
            f) Operating performance plotted on fan curves or fan rating tables.
            g) System schematic and notes including measured static pressure values, system static pressure sensor values, etc.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. TAB Field Technician Personnel:
      a. Trained and experienced in the operation of the test and balance equipment.
      b. Knowledgeable of the design of all systems scheduled for testing and balancing.
   2. TAB Engineer:
      a. A certified member of either the following organizations or trained in the practices thereof:
         1) AABC.
         2) NEBB.
         3) TABB.
      b. Acceptable firms providing testing, adjusting, and balancing services include:
         1) Mechanical Testing Services, Grandville, Michigan.
         2) Great Lakes Balancing, Grand Rapids, Michigan.
         3) Third Coast Test and Balance, Grand Rapids, Michigan.
         4) Absolute Balancing Company, South Lyon, Michigan.
         5) International Test & Balance, Southfield, Michigan.
         6) Total Balance Company, St. Clair Shores, Michigan.

B. Report Forms:
1. The report forms included in the appendix of the AABC Standard are incorporated in the work of this Section for the purpose of identifying the level of detail required for testing and reporting.
2. TAB engineer may use the AABC forms or other similar forms which present equivalent information in a logical format.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Materials:
1. Comply with requirements as specified in other Sections where applicable to provide materials essentially and functionally identical to original installation before testing and balancing work.
2. Maintain the integrity of systems for air tightness, water tightness, and durability of finish.

2.2 INSTRUMENTS

A. Instruments used for TAB work shall be as indicated in the referenced standards.

B. Calibration:
1. Instruments to have been calibrated within one year of start of TAB work.
2. Appropriate documentation shall be made available to the Engineer on request.

PART 3 - EXECUTION

3.1 PROCEDURES

A. General:
1. Determine what actual performance characteristics are deemed proper during system tests.
2. During heating season of the first year of operation, at times when directed, make final adjustments until all occupants are reasonably satisfied and all equipment is operating at peak efficiency.
3. Confirmation of proper equipment operation must be through actual observation. Computer simulation and sensor readouts are not acceptable proof.
4. Total air quantity handled by each system to within 10% of the quantity indicated or specified.

B. Air Systems:
1. Methods: Acceptable procedures for obtaining performance measurements are listed below:
a. CFM airflow for room exhaust: Use airflow hood.
b. Fan TSP: Use inclined manometer.
c. Equipment Pressure Drops: Use inclined manometer.
2. TAB Procedures for Air Systems:
a. Check all motorized and gravity backdraft dampers for proper position.
b. Inspect fans for cleanliness.
c. "Bump" motor to check for proper fan rotation.
d. Check unit performance including:
1) Fan speed.
2) Amperage and voltage.
3) Inlet, discharge and total static pressures at fan.

3.2 FIELD QUALITY CONTROL

A. Preliminary Review and Analysis:
1. If after standard balancing procedures have been carried out and readjustments attempted, the system does not perform as specified, Engineer shall be notified at once.
2. All "as is" field data shall be submitted in a preliminary report for review and analysis.

B. Final Inspection: Prior to final acceptance, all systems shall be operated to test performance as directed to the satisfaction of the Engineer:
   1. Motors, fans, and other equipment shall operate without excessive noise or vibration.
   2. Systems shall be balanced to operate within stated tolerances. If any heating unit or air outlet does not operate within the stated tolerances, then the entire system shall be considered out of balance and shall be readjusted until all units are within the stated tolerances.

C. Testing:
   1. TAB engineer shall coordinate with Contractor to schedule access to site to perform air system testing to whatever extent Engineer determines is necessary to verify accuracy of mechanical systems TAB report.
   2. TAB engineer will repeat system testing, adjusting, and balancing until Engineer verifies accuracy of data.

END OF SECTION 23 05 93

SECTION 23 31 13 – METAL DUCTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Refer to Division 23 Section “Hangers and Supports for HVAC Ductwork and Equipment” for ductwork and equipment.

1.2 SUMMARY

A. This Section includes the furnishing and installation of sheet metal ductwork, and appurtenances:
   1. As indicated on the Drawings.
   2. As specified herein.
   3. As required to provide a complete and operational air distribution system.
   4. As necessary for the proper and complete performance of the Work.
   5. Including all hangers, supports, and anchors.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASHRAE Guidelines:
      a. 2000 Handbook - Chapter 16 - "Duct Construction."
      b. 2001 Handbook - Chapter 34 - "Duct Design."
      c. ASHRAE 62.1, current version.
   2. ASTM Specifications:
      a. A480 - General Requirements for Flat-Rolled Stainless Steel and Heat-Resisting Steel Plate, Sheet, and Strip.
      b. A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
      c. A924 - General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   3. ASTM Standard Test Methods:
      a. A90 - Weight of coating on Zinc-Coated (Galvanized) Iron or Steel Articles.
   4. SMACNA Guidelines:
      a. "HVAC Duct Construction Standards, Metal and Flexible," Latest edition.
      b. "Rectangular Industrial Duct Construction Standards."

1.4 SYSTEM DESCRIPTION

A. Duct sizes indicated on Drawings are net clear inside dimensions.

B. Duct Construction Pressure Classifications:

	Duct System	SMACNA Pressure Classification
1.	Exhaust duct connected to fans: EF-1	1" W.G.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
   1. All state and local codes, and ordinances.
   2. Owner's insurer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be delivered in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter and damage by weather or elements in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer's Stamp:
   1. Manufacturer's stamp shall be on the outside of the ductwork.
   2. Stamp shall be clean and clear, indicating the metal gage.

2.2 MATERIALS

A. Galvanized Steel:
   1. Galvanized steel of lock-forming quality with minimum ASTM A653, G90 zinc coating, both sides in accordance with ASTM A90.
   2. Use for all ductwork systems unless noted otherwise.

B. Acceptable Fasteners:
   1. Rivets, bolts, or sheet metal screws.
   2. Stainless steel.

C. Tapes:
   1. High pressure rated, non-hardening, water resistant and fire-resistant.
   2. Compatible with duct material.

2.3 FABRICATION

A. General: Construct rectangular, round, and flat oval ductwork, and fittings in accordance with the SMACNA HVAC Duct Construction Standards, Metal and Flexible, current edition.

B. Transitions: Make every change in size or shape of duct with taper not exceeding 20 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install ductwork and accessories to provide a system free from buckling, warping, breathing, vibration, rattling, or whistling.
   2. Lap ducts in direction of air flow with longitudinal seams locked and hammered tight.
   3. Install ducts straight with building walls where possible and exposed.
   4. Ducts shall be air-tight, rigid, securely hung or bracketed in position.
   5. Install screws and rivets of such length that they do not interfere with the operation of manual or automatic dampers.

B. Protection of System:
   1. Cap the ends of sheet metal ductwork, including the roof openings, registers and diffuser openings with temporary durable air-tight and water-tight covers during all stages of construction in order to keep system clean.
   2. If permanent heating and cooling equipment is used prior to Substantial Completion, protection of ductwork systems shall comply with Division 23 Section “General HVAC Provisions.”

C. Duct Anchoring:
   1. Galvanized sheet metal hanger straps attached to construction.
   2. Angle metal screwed to the ductwork.

3.2 HANGING AND SUPPORT

A. All Ducts:
   1. Support in a secure manner.
   2. Subject to Engineer’s approval.

B. In accordance with Chapters 5 and 6 of the SMACNA HVAC Duct Construction Standards.

C. Remove and replace unacceptable work at no additional cost to Owner.

END OF SECTION 23 31 13

SECTION 23 33 13 – DAMPERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not limited to, the major items listed below:
   1. Gravity backdraft dampers.
   2. Control dampers.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the Work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the Work:
      a. Mechanical Subcontractor:
         1) Install control dampers.
         2) Provide gravity backdraft dampers.
         3) Furnish control dampers, linkages, and operators.
         4) Install linkages and operators on dampers.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following:
   1. NFPA 90A - Air Conditioning and Ventilating Systems.
   2. SMACNA Publications: HVAC Duct Construction Standards - Metal and Flexible.
   3. ASHRAE: 90.1 – 2019 Energy Efficient Design of New Buildings Except Low Rise Residential Buildings, with state amendments.

1.4 SUBMITTALS

A. Manufacturer's Literature:
   1. Submit For:
      a. Gravity backdraft dampers.
      b. Control dampers.
   2. Required Information:
      a. General:
         1) Dimensions.
         2) Details of construction and installation.
         3) Name of Manufacturer.
         4) Model.
      b. Control Damper:
         1) Air pressure drop.
         2) Leakage rate.
         3) Performance data as tested in accordance with AMCA Standards.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
   1. Installation and materials shall be in accordance with:
      a. All state and local codes and ordinances.
      b. Owner's insurer.

1.6 SEQUENCING AND SCHEDULING

A. Installation of control components at the Manufacturer’s factory or in the field is optional only to the extent that schedule is not adversely affected.

PART 2 - PRODUCTS

2.1 GRAVITY BACKDRAFT DAMPER

A. Manufacturer:
   1. American Warming & Ventilation, Inc.
   2. Pottorff.
   3. Louvers & Dampers, Inc.
   4. Ruskin.
   5. Greenheck.

B. General Requirements:
   1. 0.070-inch extruded aluminum blades.
   2. 0.125-inch extruded aluminum frame.
   3. Adjustable counterbalanced blades.
   4. Mill finish.
   5. Low leakage.
   6. Operable down to 0.02-inch WG.

2.2 AUTOMATIC CONTROL DAMPERS

A. Manufacturer:
   1. Ruskin.
   2. Greenheck.
   3. Pottorff.
   4. Louvers & Dampers, Inc.
   5. Johnson.
   6. Honeywell.

B. General:
   1. Provide single, multiple, parallel, or opposed blade as required.
   2. Parallel blade design for mixing applications, opposed blade for throttling application.
   3. Orient mixing dampers to converge the 2 airstreams.
   4. Provide opposed blade dampers for 2-position applications, except where noted otherwise.
   5. Where not indicated on the Drawings, damper construction shall be as follows:
      a. Use standard dampers (as described below) for all applications, except as follows.
      b. Use low leakage dampers.

C. Low Leakage Construction:
   1. Construct damper frames of minimum 14 gage galvanized sheet metal, with flanges for duct mounting with corner brackets to provide rigid frame.
   2. Damper blades shall not exceed 6 inches in width.
   3. Blades shall be airfoil shaped of extruded aluminum double wall with 1/2-inch minimum 16 gage plated tube or solid axle keyed into 12-gage pivot arms.
   4. The bearings shall be synthetic sleeve type.
   5. Blade Sealing:
      a. Provide mechanically fastened or replaceable TPV, PVC, rubber or neoprene seals.
      b. Install seals along the top, bottom and sides of the frame and along each blade edge.
      c. Seal shall provide a tight closing low leakage damper.

d. Leakage shall not exceed 8 CFM/SF at 4-inch W.G. for a 24-inch x 24-inch damper.
e. Provide flexible stainless steel jamb seal.

6. Damper blade interlock linkages shall drive the shaft of each blade, not the blade edge.

D. Damper Operators:
1. General:
a. Sized for ample power to overcome friction of damper linkage and air pressure acting on the blades.
b. Capable of operating at varying rates of speed to correspond to the dictates of the controllers and variable load requirements.
c. The operator linkage arrangement shall be such as to permit normally open or normally closed positions of the dampers as required.
2. Electronic Damper Actuators:
a. Direct coupled type designed for minimum 60,000 full stroke cycles at rated torque.
b. Coupling: V-belt and V-shaped, toothed cradle.
c. Overload Protection: Electronic overload or digital rotation sensing circuitry.
d. Fail Safe Operation: Mechanical, spring return mechanism. Provide external, manual gear release on non-spring return actuators.
e. Temperature Rating: -22 to +122 degrees F.
f. Manufacturers: Subject to compliance with the requirements, provide products by one of the following:
1) Johnson.
2) Honeywell.
3) Belimo Aircontrols (USA), Inc.
4) Siemens.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install duct accessories in conformance with:
a. These specifications where different from SMACNA.
b. Manufacturer's written instructions.
2. Dampers shall not rattle or generate airborne noise of any kind regardless of damper position.
3. Verify that dampers move freely through their entire stroke without binding.

END OF SECTION 23 33 13

SECTION 23 34 23 – HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of power ventilators.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AMCA (Air Movement and Control Association) Standards:
      a. 99 - Fabrication Standards.
      b. 210 - Laboratory Method for Testing Fans for Aerodynamic Performance Rating.
      c. 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal.
      d. 300 - Reverberant Room Method for Sound Testing of Fans.
   2. UL: 705 - Power Ventilators.
   3. ASHRAE: 90.1 – 2019 Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings, with state amendments.

1.4 SYSTEM DESCRIPTION

A. All power ventilators shall be selected as indicated on the Drawings:
   1. Airflow and static pressure indicated are minimums.
   2. Fan speed, brake horsepower (BHP) and sound ratings are maximum.

B. Manufacturer name and model number information given in equipment schedules represent quality and performance standards for that equipment.

C. Unless stated otherwise, fans shall be provided with the following:
   1. Discharge backdraft damper.
   2. Compatible curb or mounting hardware.
   3. Factory installed disconnect switch.
   4. Bird screen.

1.5 SUBMITTALS

A. Shop Drawings: For exhaust fans.
   1. Dimensions.
   2. Details of construction and installation.
   3. Name of Manufacturer.
   4. Model.
   5. Fan identity by equipment schedule Tag No.
   6. Fan curve with selection point clearly indicated for CFM, total static pressure, BHP and RPM.
   7. Electrical characteristics and project specific wiring diagrams including control wiring.
   8. Fan sound power level in sones at rated capacity.

B. Operation and Maintenance Manuals: For exhaust fans.
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Assembly, installation, alignment, adjustment and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.

4. Lubrication and maintenance instructions.
5. Guide to "troubleshooting."
6. Parts lists and predicted life of parts subject to wear.

1.6 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Regulatory Agencies Requirements:
   1. All state and local codes and ordinances.
   2. Owner's insurer.

C. Quality Assurance:
   1. AMCA ratings program certified and bearing AMCA air and sound seals.
   2. UL listed electrical components.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. All power ventilators, except as indicated herein:
   1. Greenheck.
   2. Cook.
   3. Penn Barry.
   4. Aerovent.
   5. Acme.

B. Electronically Commutated Motor: Motor shall be an electronic commutation (EC) motor specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor [or by a 0-10 VDC signal]. Motor shall be a minimum of 85% efficient at all speeds
   1. Provide with factory mounted and wired speed control:
   2. Motor and drive shall be accessible without disturbing ductwork.
   3. Motor shall be out of air stream.
   4. Motor Cover:
      a. Constructed of galvanized steel
      b. Covers motor and drives for safety
      c. Standard on unit specified with UL

2.2 GENERAL REQUIREMENTS

A. The equipment shall be factory built and factory tested.

B. The Manufacturer shall repair or replace any items which fail to obtain specified performance.

C. All fans shall be statically and dynamically balanced and tested.

2.3 DOMED CENTRIFUGAL ROOF VENTILATOR

A. Housing:
   1. Low silhouette, weatherproof, heavy gage spun aluminum housing, self-supporting, enclosing venturi-orifice and fan inlet and wheel and overlapping fan curb.
   2. With rain and snow weather guard.

3. Baked enamel finish, color as selected by Engineer.
4. Aluminum bird screen in discharge outlet.
5. Stainless steel hardware.

B. Fan Wheel:
1. All aluminum key locked to drive shaft, backward inclined, quiet nonoverlapping centrifugal fan wheel statically and dynamically balanced.
2. Permanently lubricated fan bearing.

C. Motor and Drive:
1. Comply with the requirements of Division 23 Section “Common Motor Requirements for HVAC Equipment.”
2. Standard NEMA motors built-in overload constant speed.
3. Resilient mounted outside of air stream, inside weatherproof housing.
4. Disconnect switch mounted inside housing, with factory wiring to motor.
5. Direct drive.
6. Electronically Commutated Motor: Motor shall be an electronic commutation (EC) motor specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors. Motors shall be permanently lubricated with heavy-duty ball bearings to match the fan load and prewired to the specific voltage and phase. Internal motor circuitry shall convert AC power supplied to the fan to DC power to operate the motor. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted on the motor. Motor shall be a minimum of 85% efficient at all speeds.
   a. Provide with factory mounted and wired speed control:
   b. Motor and drive shall be accessible without disturbing ductwork.
   c. Motor shall be out of air stream.
      1) Motor Cover:
         a) Constructed of galvanized steel
         b) Covers motor and drives for safety
         c) Standard on unit specified with UL

D. Roof Curb: Comply with the requirements of Division 23 Section “Penetrations for HVAC.”

E. Dampers: Refer to Division 23 Section “Dampers.”

2.4 THERMOSTATS

A. Furnish line voltage electric thermostat and mount where indicated. Wiring of thermostats to controlled devices is work of Division 26.

B. On rise in temperature above setpoint, fan will start, and intake air and exhaust fan damper will open. Coordinate with the requirements of Division 23 Section “Air Outlets and Inlets.”

C. Thermostat:
1. Line voltage type.
2. 35 degree F to 95 degree F range.
3. Single pole double throw switch action bridge cooling contacts on temperature rise.
4. Honeywell, Model T651A-2028 with a 35 to 95 degree F range.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. Verify that openings and adjacent areas are free of obstructions, and ready to receive fans.

B. Begin installation of fans only when openings conform to Specification requirements.

C. Install fan(s) and accessories in accordance with Manufacturer's instructions.

D. Secure components to openings and to each other.

E. Adjust fan, belts and components as necessary for:
   1. Smooth operation.
   2. Proper running amperage.
   3. Minimum vibration.

F. Replace components found out of alignment and balance.

END OF SECTION 23 34 23

SECTION 23 37 00 – AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all air inlet and outlet devices.

B. Division of Work:
   1. In accordance with the General Conditions, Contractor is responsible for dividing the Work among the Subcontractors and Suppliers and for delineating the work to be performed by specific trades.
   2. The following are suggestions as to how the Work may be divided. This is not a complete list of all the work:
      a. General Contractor: Install stationary louvers specified herein.
      b. Mechanical Subcontractor:
         1) Furnish stationary louvers specified herein.
         2) Coordinate with General Contractor for proper louver installation.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AMCA Publications:
      a. Standard 500 - Laboratory Methods of Testing Louvers for Rating.
      b. Standard 511 - Certified Ratings Program for Air Control Devices.

1.4 SUBMITTALS

A. Manufacturer's Literature: For all items specified herein.
   1. General:
      a. Dimensions.
      b. Details of construction and installation.
      c. Name of Manufacturer.
      d. Model.
   2. Performance at Scheduled Airflow:
      a. Maximum supply outlet throw value based on 50 fpm terminal velocity.
      b. Maximum air pressure drop in inches water gage.
      c. Maximum noise criteria (NC) level.
   3. Louvers:
      a. Performance Ratings:
         1) AMCA Certified.
         2) For Engineer’s approval prior to fabrication.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

PART 2 - PRODUCTS

2.1 STATIONARY LOUVERS

A. Manufacturers:
1. American Warming and Ventilating, Inc.
2. Pottorff.
3. Dowco.
4. Louvers and Dampers, Inc.
5. Ruskin.
6. Greenheck.

B. General:
1. Aluminum construction.
2. AMCA certified for air performance and water penetration.

C. Components:
1. 0.081-inch extruded channel frame.
2. Blades:
   a. 0.081-inch extruded with intermediate rain stop.
   b. Provide rear blade stiffeners on blades over 48 inches wide.
   c. Designed with drip trough for side runoff.
3. Screen:
   a. 5/8-inch x 0.050-inch expanded aluminum insect screen.
   b. Rear mounted.
   c. Secured with removable holding frame.
4. Damper.
   a. Motorized integral damper.
   b. Refer to Division 23 Section “Dampers.”

D. Size: As indicated on the Drawings.

E. Finish:
1. Dupont Kynar 500; or equal fluoropolymer.
2. Painted finishes: Furnished and applied by Manufacturer.
3. Color: Standard as selected by Architect.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Follow Manufacturer's instructions, subject to Engineer's approval.

B. Install registers, grilles and diffusers only after finish painting has been completed.

C. Install fixed vane return and exhaust grilles with angle of vanes perpendicular to normal line-of-sight.

D. Locate outdoor air intakes a minimum of 10'-0" from plumbing and gas fired appliance vents and exhaust fan discharges.

E. Louvers:
1. Where direct contact with steel occurs.
2. Alkali-resistant bituminous paint or synthetic resin zinc chromate primer.
3. Apply paint or primer to steel:
   a. Prior to installing louvers.
   b. As received from the Manufacturer without addition of thinner.
   c. In accordance with Division 09 – Finishes.

END OF SECTION 23 37 00

SECTION 23 82 00 – CONVECTION HEATING UNITS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not necessarily limited to, the furnishing and installation of the major items listed below:
   1. Unit heaters.

1.3 SYSTEM DESCRIPTION

A. Provide terminal heat transfer equipment as indicated on the Drawings.

B. Manufacturer name and model number information given in equipment schedules represent quality and performance standards for that equipment.

C. Design performance for terminal heat transfer is based on the following:
   1. Heating: 60 degrees F entering air temperature.

1.4 REFERENCES

A. As herein specified, the work of this Section shall comply with the following:
   1. ASHRAE Standard: 90.1 – Energy Efficient Design of New Buildings Except Low Rise Residential Buildings, with state amendments.

1.5 SUBMITTALS

A. Manufacturer's Literature: For all equipment specified herein.
   1. General:
      a. Dimensions.
      b. Details of construction and installation.
      c. Name of Manufacturer.
      d. Model.
   2. For Each Device:
      a. Identify by equipment schedule tag number.
      b. Design capacity.
      c. Color.
      d. Electrical characteristics and project specific wiring diagrams including controls wiring.
      e. List of accessories furnished.

B. Operation and Maintenance Manuals: For powered equipment.
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Assembly, installation, alignment, adjustment and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
   4. Lubrication and maintenance instructions.
   5. Guide to "troubleshooting".
   6. Parts lists and predicted life of parts subject to wear.

1.6 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Manufacturer Qualifications: Regularly engaged in production of such equipment.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. Manufacturers:
   1. Trane.
   2. International.
   3. Modine.
   4. Rittling.
   5. Vulcan.
   6. Sterling.
   7. Daikin.

B. Casing: 18 gage steel threaded connections for hanger rods and bonderized baked enamel finish.

C. Heating Element:
   1. Seamless copper tubing, 0.025-inch minimum wall thickness.
   2. Silver brazed to steel headers.
   3. Evenly spaced aluminum fins mechanically bonded to tubing.
   4. Tested with air under water at 200 psi.

D. Fan:
   1. Direct drive propeller type.
   2. Statically and dynamically balanced.
   3. Complete with fan guard.

E. Air Outlet:
   1. Adjustable pattern diffuser on projection models.
   2. 4-way louvers on horizontal throw models.

F. Motor:
   1. Totally enclosed, permanently lubricated and resiliently mounted.
   2. Motor rated at 1/8 hp and below shall have internal overload protection.

G. Thermostat: Manufacturers standard integral thermostat.

PART 3 - EXECUTION

3.1 INSTALLATION

A. In accordance with Manufacturer's installation instructions and installation details indicated on Drawings.

B. Thoroughly clean all exposed equipment pieces.

C. Vacuum clean all heating/cooling elements prior to job acceptance.

3.2 COORDINATION

A. Coordinate with Temperature Control Subcontractor to verify proper operating sequence for all units with factory installed controls which interface with the building temperature control system.

B. Coordinate with Electrical Subcontractor for power supply to units equipped with fans.

END OF SECTION 23 82 00

SECTION 23 84 16 – DEHUMIDIFIERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of package portable dehumidification equipment.

1.3 SYSTEM DESCRIPTION

A. Provide complete factory assembled portable system with corded electrical plug.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. See scheduled equipment on project Drawings.

1.5 REFERENCES

A. As herein specified, the work of this Section shall comply with the following:
   1. ASHRAE Standard: 90.1 Energy Efficient Design of New Buildings Except Low Rise Residential Buildings, with state amendments.

1.6 SUBMITTALS

A. Manufacturer's Literature: For complete unit.
   1. Dimensions.
   2. Details of construction and installation.
   3. Name of Manufacturer.
      a. Model.
      b. Design and performance criteria.

B. Operation and Maintenance Manuals:
   1. Equipment function, normal operating characteristics and limiting conditions.
   2. Maintenance instructions.
   3. Guide to "troubleshooting".
   4. Parts lists and predicted life of parts subject to wear.
   5. Outline, cross-sections, assembly drawings, engineering data and wiring diagrams.

1.7 DELIVERY, STORAGE AND HANDLING

A. All materials shall be delivered in original, unbroken, brand marked containers.

B. Handle and store all dehumidifier units in a manner which will prevent deterioration or damage, contamination with foreign matter and damage by weather or elements in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated, or contaminated units and immediately remove from the Site. Replace rejected units with new units at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 DX REFRIGERATION EQUIPMENT

A. General Description:
1. Complete factory assembled self-contained package unit requiring external service connections only.
2. Capable of unattended automatic indoor operation.

B. Indoor, Portable Units (Smaller Capacity):
1. Acceptable Manufacturer: Quest, Seaira Global; or equal.
2. Portable Unit Components:
a. Quest Hi-E Dry 195, Seaira Global Watchdog NXT-120C; or equal.
b. Controlled by integral dehumidistat with settings from 20 to 80 percent relative humidity and a positive “on” and “off” setting.
c. Portable and provide with 4 casters.
d. Contains and internal condensate pump capable of lifting condensate 17 feet and 20 feet of condensate hose.
e. Wiring is through a factory installed 6 foot NEMA power cord; 115 V with ground.
f. Water removal: Minimum 120 pints per day at 80 degrees Fahrenheit, 60 percent relative humidity.
g. See Drawing schedule for performance requirements.
3. Source Quality Control:
a. Run test all units at factory prior to shipment.
b. Provide certified test data if requested.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all dehumidification units in conformance with:
1. The Shop Drawings reviewed by Engineer.
2. The Manufacturer's recommendations.
3. As indicated on the Drawings.
4. Route condensate pipe as indicated on Drawings.

END OF SECTION 23 84 16

SECTION 26 05 00 – COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Excess Quantities and Sizes: Where quantities, sizes or other requirements on Drawings or Specifications are in excess of code requirements, Drawings or Specifications govern.

C. Conflicts: When conflicts exist between referenced Specifications or standards, more stringent requirements govern. No extra compensation for such compliance allowed.

1.2 SUMMARY

A. This Section includes the following:
1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Duct seal.
6. Duct seals and plugs.
7. Common electrical installation requirements.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with
1. NECA 1 - Standards Practices for Good Workmanship in Electrical Construction.
2. NEC – National Electrical Code (NFPA 70).

1.4 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

1.5 SUBMITTALS

A. Product Data: For sleeve seals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, and damage by weather or elements, and according to Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, weather tight wrapping.

D. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.7 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:
   1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
   2. To ensure that mounting heights and locations of electrical equipment do not interfere with all other building appurtenances such as, but not limited to, containment areas, special coatings, and other equipment.
   3. To allow easy access and disconnection of electrical equipment while ensuring the least amount of interference with other installations.
   4. To allow right-of-way for piping and conduit installed at required slopes.
   5. To ensure that connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and outside of the dedicated working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed.

D. Coordinate the filling in or repair of surfaces around penetrations with other trades. Surfaces shall be filled in or repaired with the same materials that matches the construction and properties of the surface penetrated.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated on the Drawings.

2.2 SLEEVE SEAL SYSTEMS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Advance Products & Systems, Inc.
      b. Calpico, Inc.
      c. Metraflex Co.
      d. Pipeline Seal and Insulator, Inc.
      e. Proco Products, Inc.
   2. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
   3. Pressure Plates: Plastic.
   4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Coordinate the selection and application of grout with other trades in order to match the color and properties of the surface being repaired, where applicable. In existing construction, grout shall match existing color and material properties.

B. At a minimum grout shall be:
   1. Nonshrink; recommended for interior and exterior for sealing openings in non-fired-rated walls or floors.
   2. Standard: ASTM C1107, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
   3. Design Mix: 5,000 psi, 28 day compressive strength.
   4. Packaging: Premix and factory packaged.

2.4 DUCT SEAL

A. Description: UL listed, pliable, non-hardening, non-corrosive, weather-proof putty material, designed as a moisture barrier for weather-sealing service entries, electrical cables, and conduit ducts.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Arnco Corp. - Hydra-Seal.
      b. Ilsco Corp. – DS Duct Seal.
      c. JM Clipper – Duxseal.
      d. OZ/Gedney Co. – DUX.
      e. RectorSeal - Duct Seal Compound.
      f. Thomas & Betts Corp. - DX.
      g. Or equal.

2.5 DUCT SEALS AND PLUGS

A. Cable duct seals and plugs shall be designed to effectively seal conduits, reducing the cost of cable placement and maintenance in underground construction projects and routine work.
   1. All plastic construction – corrosion proof.
   2. Pull ‘Rope Eye’ attachment (can be supplied with security hex nut).
   3. Water tight.
   4. Simple to install.
   5. Removable and reusable.
   6. Full range of sizes.
   7. Full range of forms (round, square).
   8. Full range of supported cable count (simplex, duplex, triplex, quadplex and specials).

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Roxtec.
   2. TE Connectivity.
   3. CalAm.
   4. Innerduct.
   5. Or equal.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1 and NEC.

B. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in a manner as to facilitate future disconnecting with minimum interference with other items in the vicinity.

D. Right of Way: Give to piping systems installed at a required slope.

3.2 INSTALLATIONS FOR ELECTRICAL PENETRATIONS

A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate:
   1. Exterior walls or slabs.
   2. Fire-rated floor and wall assemblies.
   3. Interior non-rated floor and wall assemblies.

B. Use core drilled holes, formed openings, or pipe sleeves for all penetrations unless penetration arrangement requires a rectangular sleeved opening or otherwise indicated herein or on the Drawings.
   1. When using a pipe sleeve:
      a. Use cast-iron pipe sleeves with integral water stop in new construction only. Coordinate installation of pipe sleeve with wall/slab construction.
      b. Use steel pipe sleeve in existing construction or new above grade interior construction.
   2. Obtain approval from Engineer before using rectangular sleeved openings not indicated on the Drawings.

C. Pipe Sleeve Installation:
   1. In walls, cut sleeves to length for mounting flush with both surfaces of walls.
   2. In floors, extend sleeves installed in floors 2 inches above finished floor level.
   3. Size sleeve to provide a minimum 1/4-inch annular clear space between sleeve and raceway or cable, unless otherwise indicated herein or on the Drawings. When using a modular mechanical seal, provide annular space between sleeve, raceway, or cable as required by seal Manufacture.
   4. Seal space outside of sleeves. Seal shall match existing surface construction and properties. When grout or similar compound is used promptly pack solidly between sleeve and wall so no void remains. Tool exposed surfaces smooth; protect while curing.

D. Penetration Types:
   1. Fire-Rated Assembly Penetrations:
      a. Apply firestopping to penetrations to maintain fire rating of walls, partitions, ceilings, and floors at penetrations. Seal penetration with firestop materials. Comply with the requirements in Division 07 Section “Firestopping”.
      b. Reference Architectural Drawings and Owner Record Drawings for fire ratings of walls and floors.
   2. Interior Penetrations of Non-Fire-Rated Walls and Floors:
      a. Seal annular space between penetration and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
      b. Comply with requirements in Division 07 Section "Joint Sealants."
      c. Repair surface to match finish and properties of penetrated surfaces.
   3. Roof-Penetrations:
      a. Roof penetrations shall be made using RMC.
      b. Seal annular space between penetration and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
      c. Comply with requirements in Division 07 Section "Joint Sealants."
      d. For new roofing installation penetrations, seal all penetrations of individual raceways as required by the roofing Manufacturer to maintain the roof warranty. Coordinate work with other trades.
      e. For existing roofing installation penetrations, seal all penetrations of individual raceways with flexible boot-type flashing units.
      f. Roof penetrations shall require the installation of duct sealing plugs in raceways. Duct seal shall be used when duct sealing plugs are not available in the size or configuration required.
   4. Exterior-Wall and Elevated Slab Penetrations:
      a. Seal penetrations using mechanical modular seals. Size penetrations as required to install mechanical modular seal.
      b. Exterior penetrations shall require the installation of duct sealing plugs. Duct seal shall be used when duct sealing plugs are not available in the size or configuration required.
      c. Repair surface to match finish and properties of penetrated surfaces.
   5. Manhole, Handhole, and Vault Penetrations:
      a. Seal penetrations using mechanical modular seals. Size penetration as required to install mechanical module seal.
      b. Manholes, handhole, and vault penetrations shall require the installation of duct sealing plugs. Duct seal shall be used when duct sealing plugs are not available in the size of configuration required.
      c. Repair surface to match finish and properties of penetrated surfaces.
   6. Varied Temperature Penetrations:
      a. Penetrations where raceways will be simultaneously exposed to different temperatures on each side of the penetration such as freezers, coolers, or room to room where the temperature variation is greater than 10 degrees Fahrenheit and one side of the room will be 60 degrees or less.
      b. Seal penetrations using mechanical modular seals where penetrated material permits. Size penetrations as required to install mechanical modular seal. Where modular mechanical seals cannot be utilized use clear silicone caulk or grout as applicable.

c. Inside of the raceway shall be sealed with duct sealing plugs. Duct seal shall be used when duct sealing plugs are not available in the size of configuration required.
d. Repair surface to match finish and properties of penetrated surfaces.

3.3 PENETRATION SEAL SYSTEM INSTALLATION

A. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of penetration. Assemble modular mechanical seals and install in annular space between raceway or cable and penetration. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 DUCT SEAL INSTALLATION

A. Install duct seal materials in strict accordance with the Manufacturer's instructions.

B. Obtain approval from Engineer prior to installing duct seal as the application may require duct seals and plugs to be utilized in lieu of duct seal.

3.5 DUCT SEALING PLUG INSTALLATION

A. Where conduits penetrate into the building, seal duct openings at conduit termination points with duct sealing plugs for all conduits entering the building to prevent migration of water and gases into the building and to prevent the condensation of water vapor inside the enclosures where the conduits terminate.

B. Duct sealing plugs shall be applied after all cables have been installed.

C. Install duct sealing plug materials in strict accordance with the Manufacturer's instructions.

D. All open ended riser conduits shall require duct sealing plugs to be installed.

END OF SECTION 26 05 00

SECTION 26 05 20 – CONDUCTORS AND CABLES – 600V AND BELOW

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all electrical conductors, cables, splices, and connectors.

B. Major Systems Include:
   1. 600V and below service entrance, feeders and electrical distribution.
   2. Branch circuit wiring.
   3. System wiring.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the standards of the following organizations as applicable to materials, construction and testing of wire cables:
   1. NEMA - National Electrical Manufacturer Association Standards.
   2. IEEE Standards.
   3. Insulated Cable Engineers Association - Standards.
   4. ASTM Standards.
   5. NEC - National Electrical Code (NFPA 70).
   6. UL508A - Standard for Industrial Control Panels.
   7. NFPA 79 – Electrical Standard for Industrial Machinery.

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Manufacturers: Firms regularly engaged in the manufacture of electrical conductor and cable products of the types and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Except as otherwise indicated, provide conductors, cables, and connectors of Manufacturer's standard materials, as indicated by published product information; designed and constructed as recommended by the Manufacturer and as required for the installation.

B. Power Wire:
1. All conductors and cables shall be new with a minimum wire size of No. 12 AWG. Manufacturer's name, type, and size shall be permanently marked on the outer covering at regular intervals and delivered in complete coils or reels.
2. Provide factory fabricated conductors of size, rating, material, and type as indicated for each service. Where not indicated, provide proper selection as determined by installer to comply with installation requirements and with NEC standards, from only the following types and conductors:
   a. Type THHN/THWN-2 dual rated, 600-Volt, 90 degrees C rated. Stranded copper for all sizes.
   b. Bare Conductors: Stranded copper for all sizes.

C. Control Cable: No. 14 AWG minimum, type THHN/THWN-2

D. Instrumentation Signal Cable:
1. One pair of No. 16 AWG stranded, tinned copper conductors, 600V polyethylene insulation, twisted pair, 100% coverage aluminum polyester shield, No. 18 AWG stranded, tinned copper drain wire with vinyl outer jacket, UL listed.
2. For use outdoors, below grade, above grade, and inside control panels.
3. Where more than 2 conductors are required for an instrument, provide multiple cables.
4. Manufacturers: Belden 8719; or equal.

E. Power Wiring Cable Accessories: For Connectors:
1. Wing nuts by Ideal.
2. Sta-Kon by Thomas & Betts.
3. Scotchlox Spring by Minnesota Mining & Manufacturing Company.
4. Compression Type 53200 by Thomas & Betts.
5. Hydent by Burndy.
6. Insulated multi-cable mechanical connector blocks by Polaris, or Ilsco.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install electrical conductors, cables, and connectors as indicated on the Drawings, in accordance with the Manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation," and in accordance with recognized industry practices to ensure that products serve the intended functions.
2. Conductors and cables shall be sized in accordance with the Drawings or, in the absence thereof, in accordance with NEC requirements. Except where indicated herein, conductor sizes greater than No. 12 AWG are indicated on the Drawings.
3. Provide a dedicated grounded conductor (neutral) for each circuit that requires a neutral for proper operation. Unless indicated otherwise on the Drawings, shared neutrals are not allowed.
4. Provide an equipment grounding conductor in all raceways. Conductor shall be sized in accordance with the National Electrical Code.

B. Voltage Drop Compensation:
   1. Provide No. 10 AWG conductors in lieu of No. 12 AWG conductors to compensate for voltage drop as follows:
      a. For each 277V, 20 ampere branch circuit that exceeds 200 feet in length between the branch circuit panelboard and the last outlet.
      b. For each 120V, 20 ampere branch circuit that exceeds 100 feet in length between the branch circuit panelboard and the last outlet.
   2. When conductor size is increased to compensate for voltage drop, provide equipment grounding conductor increased in size in accordance with NEC.

C. Installation Procedures:
   1. Install interior conductors after building is enclosed and water tight.
   2. Each conduit shall be free of moisture and debris before conductors are installed.
   3. Remove moisture from conduits by swabbing.
   4. Install conductors so insulation is not damaged. Replace all conductors that are damaged.
   5. Install conductors and cables only in code conforming raceway.
   6. Pull conductors together where more than one conductor is being installed in a raceway.
   7. Use heat shrink tubing for all instrument signal cable terminations.
   8. Use manufacturer-approved pulling compound or lubricant, where necessary. Compound shall not deteriorate conductor and insulation. Compounds shall be UL listed.
   9. Use a pulling means, including fish tape, cable or rope, and basket-weave wire/cable grips that will not damage the raceway or the wire.
   10. Keep conductor splices to a minimum.
   11. Install splices and taps which have equivalent or better mechanical strength and insulation as the conductor.
   12. Use splice and tap connectors which are compatible with the conductor material.
   13. Make all joints, splices, and connections only at accessible junction or outlet boxes, never inside conduit or fitting. Make splices in No. 10 AWG and smaller wire with insulated spiral mechanical connectors.
   14. Make splices in No. 8 AWG and larger copper wire with compression type mechanical connectors.
   15. All splices located in handholes and wet locations shall be rated for wet locations.
   16. Low voltage and signal cable splices located in handholes and wet locations shall be sealed in 2-part epoxy sealing pack, 3M Scotchcast connector sealing pack 3570G.
   17. Make conductor length for parallel feeds identical.
   18. Where exposed cables are installed, cables shall be installed parallel and perpendicular to exposed structural members and building lines.
   19. Do not lace, strap or tie feeder or branch circuit conductors together in panels, switchboards, variable speed drives, motor control centers, automatic transfer switches, boxes, and wireways.
   20. All conductors and cables shall be identified in accordance with Division 26 Section “Identification for Electrical Systems.”
   21. Use color coded conductors as follows:
      a. For Power Distribution:
         1) Phases: Black-red-blue (under 150V to ground).
         2) Phases: Brown-orange-yellow (over 150V to ground).
         3) Neutral: White (under 150V to ground).
         4) Neutral: Grey (over 150V to ground).
         5) Ground: Green identified (feeders); Green (branch circuits).
      b. For Controls:
         1) Follow industry standards (UL508A and NFPA 79) for coloring associated with control circuits and control panels:
            a) AC Ungrounded (Hot) Circuits: Red.
            b) DC Ungrounded (Hot) Circuits: Blue.
            c) AC Grounded (Neutral): White or Gray.
            d) DC Grounded (Neutral): White with Blue Stripes.
            e) Ungrounded (Hot) Circuits which remain energized when main switch is off: Orange or Yellow.
            f) Grounded (Neutral) Control Circuits which remain energized when main switch is off: White with Yellow or Orange Stripes.
            g) Equipment Grounding Conductors: Green.
   22. Support conductors in vertical raceways in accordance Division 26 Section “Hangers and Supports for Electrical Systems.”

23. Cord/cable drops from above to electrical equipment shall be mechanically supported with cable strain relief grips and adequate safety springs.
    a. The cable strain relief grips and safety springs shall be made of material suitable for areas installed.
    b. Cable strain relief grips shall be stranded tinned bronze for non-hazardous or non-corrosive areas and stainless steel for hazardous or corrosive areas.
24. Outlets:
    a. Leave at least 6 inches of free conductor at all outlets except where conductors are intended to loop without joints through outlets for fixtures or wiring device hook-ups.
    b. Free ends and loops at boxes and enclosures shall be pushed back into boxes and protected by blank cover plates or other means until interior painting and decorating work is completed.
25. Lights and outlets shall be grouped on circuits as indicated on the Drawings. Different types of circuits such as feeders, branch circuits, control circuits, and signal circuits, shall not be mixed in common conduit runs, but shall be run separately, although more than 1 circuit of the same system may be run in common conduit runs.
26. Conductor ampacity derating shall be adhered to for all conductors in accordance with the National Electrical Code.
27. Type MC cable is not permitted.

3.2 FIELD QUALITY CONTROL

A. General:
    1. Prior to energization, check conductors and cables for continuity of circuitry and for short circuits. Correct malfunctions when detected.
    2. Subsequent to conductor and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements.

END OF SECTION 26 05 20

SECTION 26 05 27 – GROUNDING AND BONDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of a complete and continuous grounding system.

1.3 SUBMITTALS

A. Test Reports: For grounding. Grounding electrode resistance test results.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. All equipment, raceway systems, interior wiring systems with neutrals, receptacles, and power outlets, motors and motorized equipment shall be grounded.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design.

B. Grounding system shall be in accordance with the current National Electrical Code (NEC).

C. Grounding system rods, connectors and clamps shall be UL labeled.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: A portion of the required materials for grounding systems are specified in the Division 26 – Electrical Sections.

B. Grounding Electrodes:
   1. Ground Rods: Copper-clad steel; 3/4-inch diameter by 10 feet in length.
   2. Where ground grids are required they shall consist of copper clad steel driven rods with underground ring bus, sized as indicated on Drawings, of bare stranded copper interconnecting cable.
   3. Ground rods to be as manufactured by Copperweld; or equal.

C. Connectors:
   1. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions as manufactured by Thomas and Betts; or equal.
   2. Irreversible Compression Connectors: Compression connections shall be irreversible, cast copper, high conductivity as manufactured by Thomas and Betts; or equal.

PART 3 - EXECUTION

3.1 DISTRIBUTION SYSTEM GROUNDING

A. Provide a green, insulated, equipment grounding conductor in each raceway (metallic and non-metallic; rigid and flexible). Equipment grounding conductors shall be sized in accordance with Article 250 of the NEC.

B. Circuit Grounding: Install grounding bushings, grounding studs, and grounding jumpers at distribution centers, pull boxes, motor control centers, panelboards, load centers, and all like equipment.

C. Bonding Jumpers:
   1. Provide green insulation, size correlated with overcurrent device protecting the wire, attached to grounding bushings on conduits, to lugs on boxes, and other enclosures.
   2. Bond to neutral only at service neutral bar.

D. Receptacles and Power Outlets: Ground receptacles and power outlets to the conduit system with a green grounding conductor sized in accordance with Article 250 of the NEC and connected between the device grounding screw and outlet box.

E. Metallic Conduit: When bare grounding electrode conductors are enclosed in metallic conduit, the conduit shall be bonded to the grounding electrode conductor(s) at both ends utilizing equipment UL listed for this purpose.

F. Ground motor bases and frames by pulling a separate equipment grounding conductor in with the motor branch circuit.

G. Expansion Joints: Provide a bonding jumper around expansion fittings in metallic conduit to maintain ground continuity. Expansion fittings may include an internal bonding jumper constructed of a tinned copper braid, sized to meet UL fault current test requirements and complying with the bonding requirements of Article 250 of the NEC.

H. Separately Derived Systems: Grounding of separately derived systems, i.e., secondary transformers, shall be in accordance with Article 250 of the NEC. Use suitable ground lugs and clamps approved for this purpose.

3.2 FIELD QUALITY CONTROL

A. Tests:
   1. Measured resistance of grounding electrode system to ground shall be 5 Ohms or less. Perform Earth Ground Resistance (Fall of Potential) tests and provide additional grounding electrodes to grounding electrode system until measured resistance to ground is 5 ohms or less.
   2. Transmit test results to Engineer.

END OF SECTION 26 05 27

SECTION 26 05 29 – HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of hangers and supports for electrical equipment and systems.

1.3 DEFINITIONS

A. Electrical Supports: Angles, channels, brackets, and mounting accessories for supporting all conduit, luminaires, switches, and other electrical equipment which are hung or mounted above floor.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. This Section defines general criteria for the selection and installation of supporting devices, but does not cover all types specifically required for the Project.

B. Choose or design supporting devices in accordance with these general criteria.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Regulatory Agencies Requirements:
   1. Provide supporting devices listed by Underwriters' Laboratory for their application as installed.
   2. Comply with National Electrical Code (NFPA 70) as applicable to construction, installation, and requirements for supporting devices.
   3. Comply with Metal Framing Manufacturers Association Standard Publication (MFMA-4); factory-fabricated components for field installation.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit Supports:
1. Where information indicated on Drawings conflicts with information herein, the more stringent requirements shall take precedence and the better quality or greater quantity of work shall be provided.
2. Single Runs: Galvanized conduit straps or ring bolt type hangers with spring clips. Do not use plumber's perforated straps.
3. All supports, such as, but not limited to, metal channel (strut) framing systems, angles, straps, hangers, etc. shall match the raceway type that is being supported. For example, galvanized conduit requires galvanized metal channel (strut) framing systems and straps, PVC coated conduit requires PVC coated metal channel (strut) framing systems and straps, PVC conduit requires PVC channel (strut) framing systems and straps.
4. In general, all hardware, such as anchors, nuts, bolts, washers, threaded rod, etc. shall match the conduit type: Galvanized steel hardware shall be used with galvanized steel rigid metal conduit; 316 stainless steel hardware shall be used with PVC and PVC coated rigid metal conduit.
5. Multiple Runs: Conduit rack with 25% spare capacity.
6. Vertical Runs: Channel support with conduit fittings.
7. Manufacturers:
   a. Cooper B-Line; a division of Eaton Corporation.
   b. ERICO International Corporation.
   c. Power-Strut; Power Engineering Co., Inc.
   d. GS Metals Corp.
   e. Michigan Hanger Co., Inc.; O-Strut Div.
   f. National Pipe Hanger Corp.
   g. Thomas & Betts Corporation.
   h. Unistrut; a brand of Atkore International, Inc.
   i. Wesanco Channel Systems; ZSi-Foster, Inc.
   j. Or equal.

B. Mounting, Anchoring, and Attachment Components
1. Mechanical-Expansion Anchors: Insert-wedge-type, 316 stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials where used. See item 2.1 A 5 above for clarification.
2. Manufacturers:
   a. Hilti, Inc.
   b. ITW Construction Products.
   c. MKT Fastening, LLC.
   d. Or equal.

C. Supports for Conductors in Vertical Conduit:
1. Install in compliance with NEC article 300.19.
2. 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.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Layout to maintain headroom, neat mechanical appearance, and to support equipment loads.
2. Secure Engineer's approval before welding or bolting to steel framing or anchoring to concrete structure.
3. Where equipment is to be suspended from cast-in-place concrete construction, set approved concrete inserts in formwork to receive hanger rods. Where equipment is to be suspended from metal deck and beam or joist construction, support equipment from beams or joists only.
4. Do not use existing supports without approval from Engineer and Owner.

END OF SECTION 26 05 29

SECTION 26 05 34 – RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of conduits and fittings for electrical wiring.

1.3 SUBMITTALS

A. PVC Coated RMC Installers: Submit Manufacturer's certified training record (i.e., sign-in sheet on Manufacturer's letterhead) for all employees trained and certified to install PVC Coated RMC.

B. Product Data:
   1. For surface raceways, wireways and fittings.
      a. Name of Manufacturer.
      b. Model number.
      c. Details of construction and installation.
      d. Electrical specifications and ratings.
      e. Dimensional data.
      f. Color and finish.

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design.

B. Regulatory Agencies Requirements:
   1. ACI – American Concrete Institute: Standards pertaining to conduits embedded in concrete (Section 6.3 in ACI 318 – Building Code Requirements for Structural Concrete and Section 6.3 in ACI 350R – Environmental Engineering Concrete Structures.)
   2. NEMA – National Electrical Manufacturer's Association – Standards pertaining to raceways.
   3. NEC – National Electric Code – As applicable to construction and installation of conduit system.
   4. Provide conduit which is listed and labeled by Underwriters' Laboratories.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner that will prevent deterioration or damage (e.g., bending, end damage, finish scoring), contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping. Provide color coded end cap thread protectors on exposed threads of threaded metal conduit.

D. Reject damaged, deteriorated, or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Rigid Metal Conduit (RMC):
   1. Galvanized Steel RMC: Galvanized steel, heavy wall conduit with threaded fittings, 3/4-inch trade size minimum, insulated bushings.

B. Rigid Nonmetallic Conduit (RNMC):
   1. Schedule 40, rigid polyvinylchloride, rated for 90 degrees C conductors, 3/4-inch trade size minimum, solvent cement connectors and couplings.
   2. Nonmetallic strap hangers allowing thermal expansion movement.
   3. Conduit to meet NEMA TC-2; fittings to meet NEMA TC-3.
   4. Expansion Coupling: Nonmetallic to compensate for thermal expansion.

C. Liquid Tight Flexible Metal Conduit (LTFMC): 3/4-inch trade size minimum. Flexible conduit with flexible, moisture-proof PVC jacket and liquid tight connectors.

D. Encased Burial (EB): PVC, rated for 90 degree C conductors, 2-inch to 6-inch trade size, solvent cement connectors and couplings. Meet NEMA TC-6 and TC-8.

E. Innerduct:
   1. Flexible, multi-cell, textile innerduct.
   2. Melting Point: 480 degrees F (minimum).
   3. Tensile Strength: 2,500 pounds (minimum)
   4. Size and number of cells as indicated on the Drawings.
   5. With pre-installed, color coded pull tapes.
   6. Manufacturer: MaxCell; or equal.

F. Joint Compound for RMC: Listed for use in cable connector assemblies and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

G. Conduit Hubs for RMC:
   1. Suitable for environment served.
   2. Grounding screw.
   3. O-ring gasket.
   4. Material: Malleable Iron with zinc electroplate.
   5. Manufacturer:
      a. Cooper Myers Hubs.
      b. Thomas & Betts.
      c. Killark.

PART 3 - EXECUTION

3.1 INSTALLATION

A. All conduits shall be exposed unless they are installed in finished areas.

B. Install conduit products in accordance with:
   1. The Drawings.
   2. The Manufacturer's written instructions.
   3. Applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation."
   4. Recognized industry practices to ensure that products serve intended function.

C. Conduit Joints: Cut square, reamed smooth and drawn up tight.

D. Threaded Conduit Joints: Apply listed anti-corrosion/anti-seize compound to threads of raceway and fittings before making up joint. Follow compound manufacturer’s written instructions.

E. Bends:
   1. Number per run for conduit that support feeder and branch circuits: Do not exceed the equivalent of 4 quarter bends (360 degrees) between pull points.
   2. Number per run for conduit that supports data/communications cabling: Do not exceed the equivalent of 2 quarter bends (180 degrees) between pull points.
   3. Make bends and offsets so as not to reduce the inner diameter of the conduit.
   4. To the extent possible, avoid using large junction boxes as 90 degree junctions.

F. Routing:
   1. Concealed Conduits: Run in a direct line with long sweep bends and offsets.
   2. Exposed Conduits: Run parallel to, and at right angles to, building lines.
   3. Run continuous from outlet to outlet and from outlets to cabinets, pull or junction boxes.
   4. Secure to boxes and cabinets with locknuts and bushings in such a manner that each system is electrically continuous throughout.

G. Cap conduit ends to prevent entrance of foreign materials during construction.

H. Provide insulated bushings on threaded conduit run terminations. Where entering the bottom of open-bottom switchboards, motor control centers, transformers, primary switches, and similar equipment provide bonding bushings and bonding jumpers.

I. Where entering the bottom of open-bottom equipment (i.e., switchboards, panelboards, motor control centers, transformers, and similar equipment) conduit shall not be installed flush with the floor/equipment pad and shall not rise more than 3 inches above the bottom of the enclosure.

J. Conduit entering control panels shall not obstruct internal components and shall allow for neat and workmanlike wire management.

K. Completely install conduit systems before installing conductors.

L. Refer to Division 26 Section “Common Work Results for Electrical” for sealing underground and above grade conduit that is exposed to temperature differences to prevent the passage of air and condensation.

M. Support:
   1. Where information on Drawings conflicts with information herein, the more stringent requirements shall take precedence and the better quality or greater quantity of work shall be provided.
   2. Adequately support conduit from structural elements of the building.
   3. Do not drill or tap structural building steel without approval from Engineer.
   4. Do not rest raceways or wiring systems on, nor support it from, ceiling suspension systems, ceiling tiles or mechanical equipment including, but not necessarily limited to ductwork and fans.
   5. Conduit shall be supported in accordance with the NEC and Division 26 Section “Hangers and Supports for Electrical Systems.”

N. Provide conduit expansion couplings where conduits cross building or structure expansion joints.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200 pound (90 kg) tensile strength. Label and leave at least 12 inches of slack at each end of pull wire.

P. LTFMC Installation:
   1. Provide separate grounding conductor in accordance with Division 26 Section “Grounding and Bonding.”
   2. Connection to light fixtures shall not exceed 6 feet in length within an accessible ceiling and 3 feet in length where exposed. Connection to solenoids, pressure switches, motors, fans, HVAC equipment, and similar equipment shall not exceed 3 feet in length.
   3. Flexible conduit shall not be used to connect to surface mounted light fixtures or other non-moving, non-vibrating, or non-adjustable equipment.

Q. Rigid Nonmetallic Conduit Installation:
   1. Provide separate grounding conductor in accordance with Division 26 Section “Grounding and Bonding.”
   2. Support conduit in accordance with the NEC.
   3. Provide expansion couplings where length change due to temperature variation exceeds 1/4-inch.
   4. When penetrating concrete surfaces or grade, make a transition to rigid steel conduit 6 inches (minimum) below the surface. Provide corrosion protection by coating the RMC with a bituminous coating from inside the encasing material to 4 inches of exposed conduit; vinyl corrosion protection tape may be installed, but must be reviewed with the Engineer prior to installation.
   5. Provide rigid steel elbows in all conduit that is underground or encased in concrete.
   6. In areas of assembly, where RNMC is installed, conduits shall be encased in a minimum of 2 inches of concrete.
   7. Where RNMC is embedded in concrete, conduit shall be securely fastened and supported in accordance with the NEC to prevent damage during concrete pours.

R. Firestopping: Firestop all conduit penetrations of fire rated barriers by using approved material to ensure integrity of the rating.

S. Underground Installation:
   1. As indicated on the Drawings, including the excavating, pumping, backfilling, shoring and removal of surplus excavated material.
   2. Underground Obstructions:
      a. Locate all that may interfere with excavation.
      b. Be responsible for damage to existing underground systems and assume all cost of repairing the same.
   3. Backfilling:
      a. Use only clean sand thoroughly compacted to prevent settling of trenched areas.
      b. In the event that backfilled areas do settle, fill and compact to finish grade, and repair all damage caused by settling.
   4. Repair all disturbed surface to match existing.
   5. Unless otherwise indicated on the Drawings, install top of conduit 30 inches below grade when located outside the walls of the building
   6. Provide warning ribbon 12 inches above conduits.

T. Embedment in Concrete:
   1. Where conduit is embedded in concrete, follow the requirements of Section 6.3 in ACI 318 – Building Code Requirements for Structural Concrete and Section 6.3 in ACI 350R – Environmental Engineering Concrete Structures.
   2. Review proposed routing of embedded conduit with Engineer prior to installation.
   3. Embedded conduit shall be installed between top and bottom reinforcement, in a manner that prevents concrete from entering the conduit system.

3.2 CONDUIT SCHEDULE

A. Where information on Drawings conflict with information herein, the more stringent requirements take precedence and the better quality or greater quantity of work shall be provided.

B. Feeders, Branch Circuits and System Conduits:
   1. Underground and In or Below Concrete: RNMC.
   2. Exterior Above Slab or Grade: RMC.
   3. Unfinished Spaces: RMC.
   4. Underground Duct Banks:
      a. Encased In Concrete: EB, RNMC.
      b. Not Encased In Concrete: RNMC.

C. Data/communications conduits in dry locations not subject to physical damage and not installed underground nor in or below concrete: RMC.
   1. Data/communication conduits shall be bonded.
   2. Data/communication sleeves, provide plastic bushings.
   3. Data/communication conduits shall be 3/4-inch minimum.

D. Lighting Fixture Support: RMC.
   1. Light fixtures shall not be supported via standard locknuts at the fixture connection. Provide fittings with set-screw or other means to prevent loosening.
   2. Hands-free swivel type hangers shall be used in dry locations. Threaded condulet fittings shall be used in Damp, Wet, Corrosive, and Hazardous Locations.

E. Connection To Equipment:
   1. Lighting Fixtures and Control Devices (including, but not necessarily limited to solenoids, pressure switches, and field instruments):
      a. Dry Locations: LTFMC.
      b. Wet or Damp Locations: LTFMC.

   2. Vibrating Equipment (including, but not necessarily limited to motors and transformers):
      a. Motors:
         1) Dry Locations: LTFMC.
         2) Wet or Damp Locations: LTFMC.
      b. Transformers:
         1) Dry Locations: LTFMC.
         2) Wet or Damp Locations: LTFMC.
      c. Equipment Mounted On Vibration Isolators:
         1) Dry Locations: LTFMC.
         2) Wet or Damp Locations: LTFMC.

F. Provide separate raceway systems for:
   1. Normal power wiring.
   2. Emergency power wiring.
   3. Data/communication wiring.
   4. A.C. signal and control wiring.
   5. Low voltage signal and control wiring.
   6. Analog instrumentation wiring.
   7. Special systems wiring.

G. Do not utilize panelboards, motor control centers, distribution equipment or like devices as raceways.

H. Provide seal-off fittings in all conduit runs that enter/leave Hazardous Locations and where entering enclosures in accordance with the NEC. Fill seal-off fittings with sealing compound prior to Substantial Completion.

I. Provide cable seals on all cable terminations in Hazardous Locations in accordance with the NEC.

J. Provide innerduct in each conduit run that contains fiber optic cable. Conduit that contains innerduct and fiber optic cable shall not be routed through Hazardous Locations without approval from the Engineer.

K. For conduits that enter NEMA Type 2, 3, 3R, 4, 4X, and 12 enclosures, provide conduit hubs with o-ring gaskets. Hubs shall be suitable for the environment served and shall match the conduit type. Grounding hubs shall be used with nonmetallic enclosures.

END OF SECTION 26 05 34

SECTION 26 05 35 – BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all electrical boxes and the major items listed below:
   1. Outlet boxes.
   2. Junction boxes.
   3. Pull boxes.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA - National Electrical Manufacturer's Association: Standards as applicable to nonmetallic fittings for underground installation.
   2. NECA - National Electrical Contractor's Association's: Applicable portions of "Standard of Installation".

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Regulatory Agencies Requirements:
   1. Provide boxes which are listed and labeled by Underwriters' Laboratories.
   2. NEC - National Electrical Code (NFPA 70) - As applicable to construction and installation of electrical boxes.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Interior Outlet Boxes:
   1. Galvanized steel outlet boxes of the type, shape, and size, including depth of box, to suit each respective location and installation; constructed with stamped knockouts in back and sides, and with threaded holes with screws for securing box covers or wiring devices.

2. In areas requiring exposed RNMC, provide nonmetallic outlet boxes of type, shape and size to suit each location. Each box is to have conduit hubs with removable plugs and a non-metallic cover. Each box shall be compatible with RNMC.

B. Interior Outlet Box Accessories:
1. As required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps, and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes being used and meet the requirements of individual wiring situations.
2. Choice of accessories is installer's option.

C. Weatherproof Outlet Boxes:
1. Corrosion-resistant cast metal, weatherproof outlet boxes, of the type, shape, and size, including depth of box, suitable for each application, with threaded conduit ends.

D. For Ceilings: 4-inch octagonal boxes for receiving 3 or less 1/2-inch conduits.

E. Surface Mounted: 4-inch square.

F. Junction and Pull Boxes:
1. Sheet steel junction and pull boxes, with screw-on covers; of the type and shape and size to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws, and washers. Dry interior location boxes shall have baked enamel finish. Damp location and exterior boxes shall have galvanized finish.

G. Flush Mounted Pull Boxes: Provide overlapping covers with flush-head cover retaining screws, prime coated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install electrical boxes as indicated, in compliance with NEC requirements and in accordance with the Manufacturer's written instructions and recognized industry practices to ensure that the boxes and fittings serve the intended purposes.
2. Provide weatherproof outlet boxes for interior and exterior locations exposed to weather or moisture.
3. Provide knockout closures to cap unused knockout holes where blanks have been removed.
4. Locate boxes and conduit bodies so as to ensure accessibility of electrical wiring.
5. Secure boxes rigidly to the substrate upon which they are being mounted, or solidly embed boxes in concrete or masonry.
6. Mount outlet boxes flush in areas other than mechanical rooms, electrical rooms, and above removable ceilings.
7. Adjust position of outlets in finished masonry walls to suit masonry course lines.
8. Do not install boxes back-to-back in same wall. Coordinate cutting of masonry walls to achieve neat openings for boxes.
9. Do not use sectional or handy boxes.
10. For boxes mounted in exterior walls install insulation behind outlet boxes to prevent condensation in boxes.
11. For outlets mounted above counters, benches, and splashbacks, coordinate location and mounting heights with built-in units. Adjust outlet mounting height to agree with required location for equipment served.
12. Outlet boxes in finished areas shall be located as indicated on the Drawings and so set that the face plates will be flush with the finish on which it is mounted. Where 2 or more devices of any kind are set side by side, set them in gang boxes unless otherwise noted on the Drawings.
13. Locate pull boxes and junction boxes above removable ceilings or in electrical rooms, utility rooms, or storage areas such that boxes will be accessible after completion of building.
14. All boxes shall have covers installed at completion of construction.

END OF SECTION 26 05 35

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of proper identification for electrical system components.

B. Items requiring identification or labeling include:
   1. Cables and conductors.
   2. Conduit systems.
   3. Controls:
      a. Motor starters.
      b. Variable frequency drives.
   4. Distribution Equipment:
      a. Disconnect switches.
      b. Enclosed circuit breakers.
      c. Transformers.
      d. Panelboards.

1.3 SUBMITTALS

A. Nameplate schedule identifying each device to be labeled and project specific label text.

PART 2 - PRODUCTS

2.1 ELECTRICAL LABELS

A. Provide engraved laminated plastic nameplate to identify each piece of electrical equipment:
   1. Nameplate shall have 3/8-inch minimum black letters on a white background.
   2. Punched or drilled for mechanical fasteners.

B. Provide printed labels by Brady or T&B to identify conductors.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Attach nameplates directly to each piece of electrical equipment. In finished areas of building, install nameplates behind enclosure door where possible.
   2. Where several conductors pass through a pull box, junction box, or enclosure, provide wire labels. Group wires before labeling.

B. Cables and Conductors:
   1. Cables and conductors shall be color-coded in accordance with Division 26 Section “Conductors and Cables – 600V and Below.”
   2. All conductors and cables for power, lighting, control, supervision, low voltage systems, etc. shall be labeled with the source and circuit number and/or match the identification provided in the manufacturer’s submittals and O&M manuals. If none of the identifiers are suitable or available, the Contractor shall devise a clear and understandable identification labeling system. Without exception, all cables and conductors shall be clearly labeled.
   3. Labeling shall occur everywhere cables and conductors are terminated or spliced.

C. Conduit Systems:
   1. Junction boxes used for fire alarm system wiring shall be red.
   2. Provide label inside each junction and pull box identifying circuit numbers for all conductors contained inside the box. Labeling shall be printed neatly with permanent, waterproof, black ink marker.

D. Controls: For each of the following control devices, provide label attached to enclosure cover. Label shall identify:
   1. Motor Starters: Name of equipment served and load (example, “EF-5, 5 HP”).
   2. Variable Frequency Drives: Name of equipment served and load (example, “P-1, 25 HP”).

E. Distribution Equipment: For each of the following pieces of electrical distribution equipment, provide label attached to enclosure cover. Label shall identify:
   1. Disconnect Switches: Name of equipment served, number of poles, ampere rating/fuse size (where applicable), and load (example, “RTU-1, 3P30/25, 8 TON”).
   2. Enclosed Circuit Breakers: Name of device as indicated on one line diagram, number of poles, and circuit breaker size (example, “MCB, 3P200”).
   3. Transformers: Name of electrical equipment as indicated on one line diagram, KVA rating, primary voltage:secondary voltage, source transformer is fed from, and load transformer feeds (example, “T-LPA, 45 KVA, 480:208Y/120V, FED FROM MSWBD, FEEDS PANEL LPA”).
   4. Panelboards:
      a. Name of electrical equipment as indicated on one line diagram, voltage-phase, and source panelboard is fed from (examples, “LPA, 208Y/120V-3Ø-4 WIRE, FED FROM T-LPA”; “DPA, 480Y/277V-3Ø-4 WIRE, FED FROM MSWBD”).
      b. Equip interior of enclosure door with a circuit directory frame, typewritten card, and clear plastic cover. Directory shall identify load description for each circuit, including spares. Hand lettering is not acceptable.

END OF SECTION 26 05 53

SECTION 26 05 73 – OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY AND ARC FLASH RISK ASSESSMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes requirements for performing a computer-based, short circuit and protective device evaluation, coordination study, and arc flash risk assessment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NFPA 70 – National Electrical Code.
   2. NFPA 70E – Standard for Electrical Safety in the Workplace.
   3. IEEE 1584 – Guide for Performing Arc Flash Hazard Calculations.

1.4 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Credentials of the subcontractor that is performing the study.

C. A preliminary draft study shall be submitted prior to releasing the electrical gear that is included in the study for manufacturing to ensure all equipment is properly rated for the available fault current. Conductor lengths may be scaled from the drawings.

D. A final study shall be submitted with the O&M manual that includes as-installed conditions, and all modifications to the systems during the construction process.

E. Short circuit and protective device evaluation, coordination study, and arc flash risk assessment:
   1. Submit a comprehensive list of each type of equipment proposed to be included in the study for review and approval by Engineer prior to execution of the study.
   2. Include copies of all project-specific arc flash hazard warning labels and 1 sample label for review and approval by Engineer.

F. Record of Final Low Voltage Circuit Protective Device Settings:
   1. Typewritten, bound in notebook form.
   2. Submit 2 copies; one printed and one electronic (PDF).

1.5 QUALITY ASSURANCE

A. Short circuit and protective device evaluation, coordination study, and arc flash risk assessment Subcontractor:
   1. Study to be performed by a Subcontractor that is currently involved in high-voltage, medium-voltage, and low-voltage power system evaluations.
   2. The Subcontractor shall have a minimum of 5 years of experience in power system evaluations.
   3. Individuals performing the study shall be registered as a Professional Engineers in the state where the Project is located.

1.6 DATA COLLECTION FOR SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION, COORDINATION STUDY, AND ARC FLASH RISK ASSESSMENT

A. Contractor Responsibilities: Provide all required data for preparation of the short circuit and protective device evaluation, coordination of study, and arc flash risk assessment. Field verify existing distribution system to obtain all required data.

B. Subcontractor Responsibilities: Provide a listing of all required data necessary to perform the short circuit and protective device evaluation, coordination study, and arc flash risk assessment immediately after award of the Contract.

PART 2 - PRODUCTS

2.1 SHORT CIRCUIT AND PROTECTIVE DEVICE EVALUATION, COORDINATION STUDY, AND ARC FLASH RISK ASSESSMENT

A. The Study shall include:
1. Each portion of the electrical distribution system from the normal and standby or emergency power sources down to, and including, the smallest adjustable trip circuit breaker in the distribution system.
2. Normal system connections *a*nd those which result in maximum fault conditions.

B. Short Circuit Current Study:
1. Provide calculation methods and assumptions, base per-unit quantities selected, one-line diagrams, source impedance data including power company system characteristics, typical calculations, and a tabulation of calculation results, conclusions, and recommendations.
2. Calculate short circuit interrupting and momentary duties (as applicable) for an assumed 3-phase bolted fault at the service entrance disconnecting means, each switchboard, each motor control center, each distribution panelboard, and other significant locations throughout the distribution system.
3. Include fault contributions of each motor, unless specified otherwise.

C. Protective Device Coordination Study:
1. Provide time-current curves graphically indicating the coordination proposed for the system, centered on conventional, full-size, log-log forms.
2. Include with each curve sheet a complete title and one-line diagram with legend identifying the specific portion of the system covered by that particular curve sheet. Utilize different colors as necessary to clearly distinguish devices.
3. Include a detailed description of each protective device identifying its type, function, Manufacturer, and time current characteristics.
4. Tabulate recommended device tap, time dial, pickup, instantaneous, and time delay settings.
5. Include on the curve sheet, as applicable, power company relay and fuse characteristics, medium-voltage equipment relay and fuse characteristics, pertinent transformer characteristics, and pertinent motor and generator characteristics.
6. The study shall include all devices down to the largest branch/feeder circuit in each motor control center and distribution panelboard, and all adjustable settings for ground fault protective devices.

D. Arc Flash Risk Assessment:
1. Determine arc flash boundary, limited approach boundary, restricted approach boundary, and incident energy at all 3 boundaries for electrical distribution equipment required to be field marked in accordance with Article 110.16 of the National Electrical Code.
2. Calculations to be developed based on IEEE 1584.
3. Provide arc flash hazard warning labels for all electrical equipment included in the Study. Label information shall include all information as required by the Codes and Standards listed herein, and information including, but not limited to, the nominal system voltage, all 3 boundary distances, and the incident energy at each boundary. If arc flash reduction technologies are incorporated with the equipment, the reduced incident energy at each boundary shall also be included.
4. Electrical equipment with multiple sections and/or front and rear access, shall have labels installed on every section and/or both front and rear access panels.

E. Circuit Protective Devices: Notify Engineer in writing of circuit protective devices not properly rated for the available fault conditions.

F. Phase and Ground Coordination:
   1. Include coordination of the generator protective devices.
   2. Show the generator decrement curve and damage curve along with the operating characteristics of the protective devices.
   3. Obtain information from the generator Manufacturer and include the actual generator impedance, time constraints, and current boost data.
   4. Do not use typical values for the generator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install arc flash hazard warning labels on all electrical equipment, included in the Study, with all the required information indicated herein.

B. Contractor shall perform field adjustments of protective devices and replace fuses as required to place the equipment in final operating condition. Settings for protective devices, fuse types and fuse sizes shall be in accordance with the recommendations of the reviewed coordination study.

END OF SECTION 26 05 73

SECTION 26 22 13 – LOW VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all transformers.

1.3 REFERENCES

A. Except as herein specified, or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA (National Electrical Manufacturers Association) Standards:
      a. ANSI/NEMA ST20 - Dry-Type Transformers for General Applications.
      b. ANSI/NEMA TR27 - Commercial, Institutional and Industrial Dry-Type Transformers.
   2. DOE (Department of Energy): 2016 Efficiency Standards.

1.4 SYSTEM DESCRIPTION

A. General: Transformers as defined for this Section include all air-cooled, dry-type equipment:
   1. 600 volt and below.
   2. Single-phase and 3-phase.

B. Design and Performance Requirements:
   1. Sound Levels:
      a. Not to exceed NEMA standards.
      b. Manufacturer certified for all units furnished.

1.5 SUBMITTALS

A. Shop Drawings: For transformers.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Assembly drawings, including elevations, plans, sections, dimensions, weight, and conduit entry locations.
   5. Mounting configuration.
   6. Electrical Ratings:
      a. KVA.
      b. Primary and secondary voltages.
      c. Impedance.
      d. Temperature rise.
   7. Options and accessories.
   8. Color and finish.

B. Installation instructions for transformers.

1.6 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Regulatory Agencies Requirements:
   1. All transformers shall carry the Underwriters' Laboratory label.
   2. Single phase transformers, 167 KVA and smaller, and 3 phase transformers 500 KVA and smaller shall be UL listed and labeled.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors in a controlled environment with low moisture content. Do not store outdoors.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.8 PROJECT CONDITIONS

A. Provide temporary temperature/humidity control:
   1. For all installed, nonenergized transformers.
   2. In a manner which will maintain atmospheric moisture content inside the transformers at an acceptable minimum.

1.9 WARRANTY

A. Manufacturer shall furnish for all transformers: 2-year unconditional warranty.
   1. Beginning on date of delivery to Contractor.
   2. Contingent on Manufacturer approved installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products produced by one of the following Manufacturers; or equal:
   1. Schneider Electric; Square D Products.
   2. Eaton Corporation.
   3. General Electric; ABB, Inc.
   4. Siemens USA.

2.2 TRANSFORMERS

A. Voltage and phase as indicated on the Drawings.

B. Voltage Taps:
   1. Single Phase: Four 2-1/2% FCBN.
   2. Three Phase: Two 2-1/2% FCAN and four 2-1/2% FCBN.

C. Insulation:
   1. An UL recognized 220 degrees C insulating system, operating at 80 degrees C rise over an ambient of 40 degrees C.
   2. Transformers shall have the ability to carry a 30% overload at rated voltage without exceeding this rating.

D. Vibration: Completely isolate the core and coil unit from the enclosure by means of vibration absorbing mounts.

E. Ground Lugs: Supply transformers with external ground lugs internally connected to transformer neutral.

F. Cores:
1. Construct cores of nonaging, high-permeability, grain-oriented, cold-rolled silicon steel.
2. Minimum acceptable steel grade: Electrical steel graded M-6.
3. Keep magnetic flux densities well below the saturation point, and in no case shall these exceed a design level of 14.8 Kilogauss, for units K-rated.
4. The core shall not saturate even when the transformer is subjected to 120% of nameplate voltage.
5. Clamp core with structural angle and bolt to the enclosure to prevent damage during shipment.

G. Coils: Wound of continuous aluminum or copper conductors without splices.

H. Impregnation:
1. Thoroughly dry core and coil with core brackets.
2. Impregnate with a minimum of two complete cycles of a silicone varnish.
3. Complete with 1 finishing coat of a high temperature sealer varnish.

I. Enclosure:
1. Degrease, clean, phosphatize, and prime entire transformer enclosure.
2. Finish with baked enamel.
3. Air dry finish will not be accepted as being equal.

J. Terminal Compartments:
1. Readily accessible with clamp type terminals sturdily mounted.
2. Size all wiring compartment covers so that when removed the entire wiring compartment area is exposed.

K. Core Mounting: Mount core and coil of all cabinet type transformers above the base in order to provide space at the bottom of the transformer enclosure so that wiring is never exposed to temperatures higher than the ambient temperature.

L. Grounding: Ground core and coil assembly to the enclosure with flexible copper strap.

M. Nameplates: Permanently attach metal nameplates, marked in accordance with NEMA specifications, to the transformer in a readily accessible position.

N. Case Temperature: The maximum top or case temperature at full load shall not exceed 35 degrees C above ambient.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting: Mount all transformers as indicated on the Drawings.

B. Equipment Grounding: Provide transformer enclosure equipment grounding in accordance with the latest applicable edition of the National Electrical Code.

C. Neutral Conductor Grounding:
1. Provide a THW insulated grounding conductor from the neutral of a Wye connected secondary 3 phase transformer or the secondary center tap of a single phase transformer to the nearest acceptable grounding electrode.
2. This work shall be in accordance with the latest applicable edition of the National Electrical Code.

D. Install transformers in accordance with Manufacturer's recommendations.

E. Technical Literature: Turn over all technical literature and Manufacturer's guarantee to Owner and obtain a signed receipt.

3.2 ADJUSTING

A. Adjust the full capacity taps under no load so that the average secondary phase to neutral voltage for the 3-phases is as close as possible to 120 volts.

3.3 CLEANING

A. Shipping Protection: Remove all shipping and packing protection, include core clamps.

B. Cleaning: Clean interior and exterior of transformers and leave them free of dust and particles that accumulate during construction prior to turning system over to Owner.

END OF SECTION 26 22 13

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all distribution panelboards, and lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include name of manufacturer and model numbers.
   2. Include materials, switching and overcurrent protective devices, SPDs, accessories and components indicated.
   3. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Project specific assembly drawings, including elevations, plans, sections, dimensions, weight, and conduit entry locations.
   5. Project specific electrical ratings:
      a. Voltage.
      b. Amperage.
      c. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Project specific enclosure types.
      a. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges and locks.
   7. Project specific color and finish.
   8. Project specific one line diagram.
   9. Project specific options and accessories.

C. Installation Instructions: For panelboards.

D. Operation and Maintenance Manuals: For panelboards.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
   4. Maintenance instructions.
   5. Guide to "troubleshooting."
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
   8. Test data and performance curves.

1.4 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. All panelboards and accessories shall bear the UL label.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 240/120 V AC Maximum:
1. Schneider Electric; Square D Products: NQ.
2. Eaton Corporation: PRL1X.
3. ABB, Inc.: ReliaGear Type RQ.
4. Siemens USA: Type P1, P2 or P3 Series.

B. All panelboards shall be products of the same Manufacturer.

2.2 MATERIALS

A. General:
1. All panelboards shall have plated copper bus bars and full-sized neutral bar.
2. Bussing shall meet UL Standard 67 for maximum heat rise.
3. Bussing Type: Distributed phase.

B. Circuit Breaker Panelboards:
1. Automatic circuit breaker type with individual breaker unit for each circuit, interchangeable, and removable without disturbing adjacent units.
2. Complete front trim with door and flush lock, with 2 keys.
3. Cabinets and fronts shall meet UL Standards for gutter space and material gage.
4. All panelboards shall have common keying.
5. All panelboards shall have a circuit directory frame with plastic cover and card mounted inside cover.
6. Trim for panelboards shall have door-in-door construction with piano hinge. Outer door shall permit full access to the panelboard interior. Inner door shall permit access to breaker operating handles and labeling but current carrying terminals and bus shall remain concealed.
7. Flush mounted double tub panelboards in finished areas shall have a common front cover.
8. Panelboard shall have electrical rating as indicated on the Drawings.
9. Flush mounted panelboards shall have cover flange to overlap cabinet.
10. Finish panelboards in gray enamel over rust inhibitor primer.
11. Branch circuit breakers are to be bolt-on.
12. Load centers not allowed unless noted otherwise.

C. Short-Circuit Rating: Provide a single integrated rating of each panelboard certifying capability of withstanding fault stresses equal to the lowest interrupting rating of any overcurrent protective device contained in the panelboard.

D. Surge Protective Devices (SPD): As specified in Division 26 Section “Surge Protective Devices.”

2.3 IDENTIFICATION

A. Panelboard Nameplate: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located at an accessible location on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated, typewritten circuit directory mounted inside panelboard door and placed in metal frame with transparent protective cover.
   1. Circuit directory shall identify specific purpose and location of equipment served with detail sufficient to distinguish it from all other circuits.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which panelboards and enclosures are to be installed and notify Engineer in writing of conditions detrimental to the operation or the proper and timely completion of the work.

3.2 INSTALLATION

A. Anchoring:
   1. Anchor enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically secured.
   2. Locate top of enclosures approximately 6'-0" above floor, at a masonry joint if applicable.
   3. Mount free-standing distribution panelboards on 4-inch high concrete pads with 1-inch chamfered edges.
   4. Where panelboards are flush mounted, stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab, not on grade, into accessible ceiling space below.

B. Circuit Directories:
   1. Upon completion of work, install project specific, computer generated, typewritten circuit directories in all lighting and appliance branch-circuit panelboards.

C. Panelboard Identification Nameplates: Label each panelboard with a nameplate complying with the requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Division 26 Section "Identification for Electrical Systems" identifying source of remote circuit.

3.3 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

END OF SECTION 26 24 16

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all wiring devices and the major items listed below:
   1. Receptacles.
   2. Switches.
   3. Wall plates.
   4. Box covers.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA - National Electrical Manufacturer's Association - Standards for general and specific purpose wiring devices WD-1, WD-s.
   2. Federal Specifications WC-596 and WS-896.
   3. Underwriter Laboratories (UL) Standard 498.

1.4 SUBMITTALS

A. Shop Drawings: For wiring devices.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation
   4. Electrical specifications and ratings.
   5. Dimensional data.
   6. Color and finish.

1.5 QUALITY ASSURANCE

A. Regulatory Agencies Requirements:
   1. NEC - National Electrical Code (NFPA 70) as applicable to construction and installation of electrical wiring devices.
   2. UL Labels. Provide wiring devices which have been tested and are listed and labeled by Underwriters' Laboratories.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 WIRING DEVICES

A. General:
1. Provide factory-fabricated wiring devices in type, color, and electrical rating as indicated below.
2. Where type and grade are not indicated, proper selection shall be determined by installer to fulfill the wiring requirements and to comply with NEC and NEMA standards for wiring devices.

B. Manufacturers: Provide equal products by one of the following Manufacturers for switches and receptacles specified:
1. Eaton (Arrow Hart).
2. Leviton Manufacturing Co., Inc.
3. Hubbell Incorporated: Wiring Device-Kellems.
4. Pass & Seymour/Legrand (Pass & Seymour).

C. Switches:
1. Switch Rating: 20 amp, 1201277V, specification grade, quiet operating.
2. Switch Provisions: Back and side wiring.
3. Device Color: Ivory.
4. Manufacturer: Hubbell HBL1220 Series.

D. Duplex Receptacles:
1. Ratings: 20 amp, 125V, industrial, heavy duty, tamper-resistant, specification grade.
2. Provisions: Back and side wiring, grounding screw.
3. One Piece Mounting Strap: 260 brass, 0.05-inch thick.
4. Device Color: Ivory.
5. Manufacturer: Hubbell HBL5362TR Series.

E. Ground Fault Circuit Interrupter Duplex Receptacles:
1. Ratings: 20 amp, 125V, self-test, extra heavy duty, industrial, tamper-resistant, specification grade.
2. Provisions: Feed through protection.
3. Nickel plated brass mounting strap.
4. Device Color: Ivory.
5. Manufacturer: Hubbell GF5362SG Series.

F. Wall Plates:
1. Number: Provide a single (switch or duplex outlet) wall plate for wiring devices grouped at each location.
2. Attachment: Provide metal screws for securing plates to devices, screw heads colored to match finish of plate.
3. Construction:
   a. Stainless Steel: 0.04-inch thick, Type 302 satin finished stainless steel, accurately die cut, protected with release paper.
   b. Plastic: High abuse nylon or polycarbonate, color to match device.
   c. Cast Metal: Die cast profile, ribbed for strength, flash removed, painted with gray enamel, furnished complete with 4 mounting screws with gaskets.
   d. Steel: Hot dip galvanized, 1.25 ounce per square foot minimum.
4. Plate Application:
   a. When surface mounted device boxes are utilized, the plate shall match the box (i.e., a 4 square box shall require a raised device cover, an FS or FD box shall require an FS or FD device cover, and a PVC coated box shall require a PVC coated cover, etc.)
   b. Flush Mounting Devices: Beveled type with smooth edge:
      1) Finished Areas: 304 stainless steel.
      2) Unfinished Areas: Plastic.
   c. Devices In Process Spaces: Plastic.
   d. Weatherproof Outlet Covers and Face-Plates:
      1) Cast aluminum, NEMA 3R, weatherproof while-in-use outlet cover with faceplate, faceplate gasket and corrosion proof fasteners.
      2) Manufacturers: Hubbell, Leviton.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
1. Install wiring devices in accordance with:
a. The Drawings.
b. Manufacturer's written instructions.
c. Applicable requirements of NEC and National Electrical Contractors Association's "Standard of Installation".
d. Recognized industry practices to ensure that products serve intended function.
2. Delay installation of devices until wiring is completed.
3. Install receptacles and switches only in electrical boxes which are clean and free from excess building materials and debris.

B. Switches:
1. Install as indicated on the Drawings to control lights as indicated.
2. Where more than 1 wall switch is installed in same location, set under 1 cover plate.
3. .

C. Receptacles:
1. Locate approximately as indicated on the Drawings, long dimension vertical, with grounding pole at top.
2. Centerline generally at 18 inches above floor on a tile or block joint unless otherwise indicated on the Drawings. When mounting height exceeds 27 inches above floor, mount horizontally with grounding pole at left.
3. Refer to architectural Drawings for specific location requirements for architectural details when located above counters (long dimension horizontal), and for centering to meet architectural conditions.
4. Refer to mechanical Drawings for coordination with mechanical equipment, radiation, fin tube, grilles, and diffusers.
5. Provide bonding jumper from outlet to box.

D. Wall Plates:
1. Install coverplates on all wiring devices
2. Plate shall cover entire wall opening.

3.2 FIELD QUALITY CONTROL

A. Testing: Test wiring devices to ensure electrical continuity of grounding connections, and test after energizing circuitry, to demonstrate compliance with requirements.

3.3 PROTECTION OF WALL PLATES AND RECEPTACLES

A. Upon installation of wall plates and receptacles, advise Subcontractors regarding proper and cautious use of convenience outlets. At time of Substantial Completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

END OF SECTION 26 27 26

SECTION 26 28 00 – LOW VOLTAGE CIRCUIT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all low voltage circuit protective devices:
   1. The types of low voltage circuit protective devices required for the Project and specified in this Section include the following:
      a. Fuses.
      b. Circuit breakers.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. UL 489 – Molded Case Circuit Breakers.
   2. NEMA AB1 – Molded Case Circuit Breakers.
   3. NEMA 250 – Enclosures for Electrical Equipment.
   4. NFPA 70 – National Electrical Code.

1.4 SUBMITTALS

A. Manufacturer's literature for each type of low voltage circuit protective device furnished to include:
   1. Name of Manufacturer.
   2. Model.
   3. Time-current curves.
   4. Interrupt ratings.
   5. NEC class.
   6. Details of construction and installation.
   7. Options and accessories.

B. Installation Instructions: For low voltage circuit protective devices.

C. Operation and Maintenance Manuals: For low voltage circuit protective devices.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
   4. Maintenance instructions.
   5. Guide to "troubleshooting."
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
   8. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Provide fuses and circuit breakers which have been tested, listed, and labeled by Underwriters' Laboratory.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 FUSES

A. General: Provide fuses manufactured by Bussmann, Inc. as required for all motor starters, fused disconnect switches, and other equipment requiring fuse protection as indicated on the Drawings, or in absence thereof, as selected by the installer to meet the specific electrical requirements of the equipment being served. Select only from the following:
   1. Dual element plug fuses, 0-30 ampere, 150 volt, 10,000 ampere interrupting rating: Buss "Fusetron".
   2. Dual element fuse, 0-600 ampere, 250 or 600 volt, 200,000 ampere interrupting rating, Type R-K5: Buss "Fusetron".
   3. 601 amperes and above, 250 or 600 volt, 200,000 ampere interrupting rating: Buss "Hi-Cap".

B. All fuses shall be by one Manufacturer.

2.2 CIRCUIT BREAKERS

A. General:
   1. Provide required circuit breakers for installation in panelboards, switchboards, individual enclosures, or motor control centers. Circuit breaker Manufacturer shall be that of the equipment in which it is installed or shall be supplied by that equipment Manufacturer.
   2. Provide electronic trip circuit breakers where indicated on the Drawings.
   3. All breakers shall be rated for the applied voltage and have a minimum 10,000-amp interrupt rating.

B. Mechanism: Molded case circuit breakers shall have over center toggle-type mechanisms, providing quick-make, quick-break action. Breakers shall be calibrated for operation in an ambient temperature of 40 degrees C. Each circuit breaker shall have trip indication by handle position and shall be trip-free. 2 and 3 pole breakers shall be common trip.

C. Thermal Magnetic Trip:
   1. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole.
   2. Circuit breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to ensure uniform tripping characteristics in each pole).
   3. Single pole 15 and 20 ampere breakers shall be SWD rated.

D. Enclosures:
   1. Provide a UL listed circuit breaker enclosure for each individually mounted circuit breaker.
   2. Enclosure to have NEMA rating for its intended location (NEMA 12, 3R, 4).
   3. Provide handle mechanism padlockable in "OFF" position.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fuses in all combination motor starters, fused disconnects, and equipment as required. Install circuit breakers in all panelboards, switchboards, and motor control centers as required.

3.2 FIELD SETTINGS

A. Perform field adjustments of protective devices as required to place the equipment in final operating condition. Settings shall be in accordance with the recommendations of the reviewed coordination study.

END OF SECTION 26 28 00

SECTION 26 28 20 – ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all switching devices or means of disconnecting motors and other electrically powered equipment.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA - National Electrical Manufacturers Association: Standard KS1 for enclosed switches.

1.4 SUBMITTALS

A. Shop Drawings: For disconnect switches.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Assembly drawings, including elevations, plans, sections, dimensions, weight, and conduit entry locations.
   5. Electrical Ratings:
      a. Voltage.
      b. Amperage.
      c. Interrupt rating.
      d. Enclosure type.
   6. Color and finish.
   7. Options and accessories.

B. Installation Instructions: For disconnect switches.

C. Operation and Maintenance Manuals: For disconnect switches.
   1. Equipment function, normal operating characteristics, and limiting conditions.
   2. Assembly, installation, alignment, adjustment, and checking instructions.
   3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
   4. Maintenance instructions.
   5. Guide to “troubleshooting.”
   6. Parts list and predicted life of parts subject to wear.
   7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams.
   8. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed submittals.

B. Regulatory Agencies Requirements:
   1. Comply with National Electrical Code (NFPA 70) as applicable to construction and installation of electrical disconnect switches.
   2. Provide disconnect switches which have been listed and labeled by Underwriters' Laboratories.
   3. Comply with OSHA lockout/tagout requirements.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers, or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 FABRICATED SWITCHES

A. Manufacturers: Provide products produced by one of the following Manufacturers (for each type of switch):
   1. Schneider Electric; Square D Products.
   2. General Electric; ABB, Inc.
   3. Siemens, USA.
   4. Eaton Corporation.

B. General:
   1. Provide heavy duty disconnect switches for all motors and equipment as indicated on the Drawings.
   2. Provide disconnect switches for all motors not in sight of supplying distribution panel whether indicated on the Drawings or not, as required by NEC.

C. Switch Enclosures: Provide disconnect switches with NEMA enclosures 1, 3R, 4X, 7, or 12 as indicated on the Drawings, or in absence thereof, as determined by installer to fulfill the requirements of the environment.

D. Heavy Duty Safety Switches:
   1. Provide heavy duty type, sheet steel enclosed safety switches, of the type and size and electrical characteristics indicated, surface mounted, fusible or nonfusible, rated at 250 or 600 volts, 60 hertz, 3 blades, incorporating quick-make, quick-break type switches, constructed so switch blades are visible in "off" position with door open; equipped with operating handle which is an integral part of the enclosure base and whose position is easily recognizable and is padlockable in the "off" position; with current carrying parts constructed of high-conductivity copper, and silver-tungsten type switch contact; with positive pressure type reinforced fuse clips.
   2. Fuse clips shall accept only Class R type fuses.
   3. All disconnect switches shall be horsepower rated.

E. Switch Interlock:
   1. Provide switches with dual cover interlock to prevent opening door with switch in "on" position or closing switch with door open.
   2. Interlocks shall be defeatable with the use of a screwdriver to intentionally gain access to an energized switch in the "on" position.

PART 3 - EXECUTION

3.1 INSPECTION

A. General:
1. Examine the areas and conditions under which disconnect switches are to be installed and notify Engineer in writing of conditions detrimental to the proper and timely completion of the work.
2. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Engineer.

3.2 INSTALLATION

A. General:
1. Install disconnect switches where indicated, in accordance with Manufacturer's written instructions, the applicable requirements of NEC and the National Electrical Contractors Association's "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.
2. Provide fused disconnect switches serving rooftop units and all other heating, air conditioning, and refrigeration equipment comprising of multimotor or combination loads.

B. Coordination: Coordinate disconnect switch installation work with electrical raceway and cable work, as necessary for proper interface.

C. Location:
1. Install disconnect switches used with motorized equipment within sight of the controller position unless otherwise indicated.
2. Mount on wall whenever possible, otherwise provide supporting device adjacent to equipment being served.

D. Fuses: Provide fuses for disconnect switches in accordance with Division 26 Section “Low Voltage Circuit Protective Devices.”

END OF SECTION 26 28 20

SECTION 26 29 13 – ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all enclosed controllers and contactors.

B. The types of enclosed controllers and contactors required for the Project include the following:
   1. Manual motor starters.
   2. Magnetic motor starters.
   3. Combination magnetic motor starter/motor circuit protector disconnect switches.
   4. Contactors.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. NEMA Standards:
      a. AB 1 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.
      b. AB 3 – Molded Case Circuit Breakers and Their Application.
      c. ICS 2 – Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
   2. ANSI/NETA Standards:
      a. ATS – Acceptance Testing Specifications for Electrical Power Equipment and Systems.
   3. NFPA Standards:
      a. 70 – National Electrical Code.
      b. 70E – Standard for Electrical Safety in the Workplace.
   4. Underwriters Laboratory (UL) Standards:
      a. 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
      b. 508 – Standard for Industrial Control Equipment.
      c. 508C – Power Conversion Equipment.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed controller and contactor. Include shipping and operating weights, features, performance, electrical ratings, operating characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each enclosed controller and contactor, manufacturer's approval drawings as defined in UL 845. In addition to requirements specified in UL 845, include dimensioned plans, elevations, and sections; and conduit entry locations and sizes, mounting arrangements, and details, including required clearances and service space around equipment.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Vertical and horizontal bus ratings.
   5. Color and finish.
   6. Options and accessories.
   7. Show tabulations of installed devices, equipment features, and ratings. Include the following:
      a. Each installed unit's type and details.
      b. Factory-installed devices.
      c. Enclosure types and details.
      d. Nameplate legends.

e. Short-circuit current (withstand) rating.
f. Features, characteristics, ratings, and factory settings of each installed device.
g. Specified optional features and accessories.

8. Project Specific Schematic and Connection Wiring Diagrams:
   a. Identify power, signal, and control wiring for each controller and contactor.
   b. Clearly identify all field wiring requirements.
   c. Typical diagrams are acceptable for multiple motors or loads controlled in the same manner.

C. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

D. Installation Instructions: For enclosed controllers and contactors. Include a copy of the Manufacturer's Field Service Division's commissioning, acceptance testing, and start up procedures.

E. Operation and Maintenance Manuals: For enclosed controllers and contactors.
1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment, and checking instructions.
3. Operating instructions for start-up, routine and normal operating, regulation and control, shutdown, and emergency conditions.
4. Maintenance instructions.
5. Guide to "troubleshooting".
6. Parts lists and predicted life of parts subject to wear.
7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams. Wiring diagrams shall reflect final, as-installed conditions and include wire numbers.
8. Manufacturer's Record Drawings: As defined in UL 845. In addition to requirements specified in UL 845, include field modifications and field-assigned wiring identification incorporated during construction by manufacturer, Contractor, or both.
9. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed submittals.

B. All equipment shall be tested in accordance with NEMA ICS-2, bear the UL Label, and be listed for the application specified.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.7 COORDINATION

A. Coordinate features of enclosed controllers, contactors, and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each enclosed controller and contactor with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor or load.

1.8 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Power Fuses: Equal to 10% of quantity installed for each size and type, but no fewer than 3 of each size and type. Provide 1 fuse puller.
   2. Control Circuit Fuses: Equal to 10% of quantity installed for each size and type, but no fewer than 2 of each size and type. Provide 1 fuse puller.
   3. Indicating Lights: 2 lamps and lenses of each type and color installed.
   4. Auxiliary Contacts: 1 spare for each size and type of magnetic controller and contactor installed.
   5. Power Contacts: 3 spares for each size and type of magnetic controller and contactor installed.
   6. Coils: 1 for each size and type of magnetic controller and contactor installed.
   7. Overload Relays: One for each size installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Provide products manufactured by one of the following:
   1. Eaton Corporation.
   2. General Electric; ABB, Inc.
   3. Rockwell Automation; Allen-Bradley.
   4. Schneider Electric; Square D Products.
   5. Siemens USA.

B. All enclosed controllers and contactors to be of the same Manufacturer.

2.2 MATERIALS AND EQUIPMENT

A. Manual Motor Starters for Fractional HP Motors:
   1. Operating mechanism shall be of the quick-make, quick-break toggle switch type and shall be mechanically trip-free requiring a reset operation before the starter can be reset. Contacts shall be silver alloy. Noncurrent carrying parts shall be mounted on molded porcelain, bakelite, or composition base.
   2. Overload protection shall be provided with 1 thermal overload heater block for each pole. All overload relays shall be of the melting alloy type.
   3. All FHP manual starters shall be equipped with thermal overload relay and handle guard/lock-off mechanism.
   4. Manual starters shall include an on-off indicating light. Light to be red unless indicated otherwise.

B. Enclosed Controllers:
   1. Motor Starters: Combination type (disconnect and controller) rated in accordance with NEMA size designations. Fractional sizes and ratings in accordance with IEC recommendations are not acceptable. Comply with NEMA ICS 2, general purpose, Class A.
   2. Circuit Breakers (Motor Circuit Protector) Disconnect: UL 489, NEMA AB 1, and NEMA AB 3, with interrupting rating to comply with available fault current, instantaneous (magnetic trip) only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes. Ampere rating to be selected per horsepower indicated on the Drawings. Lockable Handle: Accepts 3 padlocks and interlocks with cover in closed position and includes a defeatable interlock to prevent opening unless the disconnect is OFF. Auxiliary contacts “a” and “b” arranged to activate with MCP handle.
   3. Controllers:
      a. Full-voltage, non-reversing, NEMA Size 1 (minimum), electrically held, field replaceable coil and contacts, auxiliary contacts field installable and removable. Terminal temperature rise is not to exceed 50 degrees C in accordance with NEMA standards. Provide surge suppressor across each contactor coil.
   4. Overload Relays:
      a. Solid State Type:
         1) Self-powered, with current trip range adjustability. Switch or dial selectable for motor running overload protection.
         2) Sensors in each phase.

3) Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
5) Provide cover mounted “reset” pushbutton.

5. Contactor Coils: Pressure-encapsulated type.
6. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide, assembled to allow inspection and replacement without disturbing line or load wiring.
7. Terminal Blocks: Pull apart type for power and control to allow unit withdrawal without disconnecting wiring. Use screw type terminals suitable for ring and tongue lugs for control wiring and box lug type for power wiring.
8. Control Power: 120 VAC; obtained from integral CPT, with primary and secondary fuses; with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
9. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller.

C. Enclosures:
1. Provide enclosed controllers and contactors with NEMA enclosures 1, 3R, 4X, 7 or 12 as indicated on the Drawings or schedules, or in absence thereof, as determined by installer to fulfill the requirements of the environment.
2. Constructed to fully compartmentalize the starter and arranged to permit access to starter, contactor, control power transformer, fuses, and other components without requiring disassembly.

D. Contactors:
1. Provide contactors that have voltage and current rating as indicated on the Drawings.
2. Suitable for continuous duty with all types of loads.
3. Totally enclosed silver alloy double break power contacts capable of making and breaking any load within the rating of the contactor without the assistance of auxiliary arcing contacts. Contacts shall be removable without disturbing line or load wiring.
4. Industrial duty and rated 600 volts even though they may be used for commercial duty or at lower voltage or both.
5. Electrically Held: Contactor coils shall be continuously rated and encapsulated.
6. Contactors: Have on-off-auto switch in cover of NEMA 1 enclosure.
7. Contactors shall include an LED push to test type on-off indicating light. Indicating light shall be red in color unless noted otherwise.

E. Auxiliary Devices
1. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; UL listed; factory installed in controller or contactor enclosure cover unless otherwise indicated.
a. Push Buttons, Indicating Lights, and Selector Switches: Full size, heavy-duty, oil-tight type, industrial grade.
1) Push Buttons: Maintained or momentary contacts as indicated.
2) Indicating Lights: LED type; color as indicated; with push to test feature where indicated.
3) Selector Switches: Maintained contacts with number of positions as indicated.
b. Elapsed-Time Meters: Six digit, non-resettable, heavy-duty with readout in hours and tenths.
2. Control Relays: Heavy duty, 600 volt, machine tool type, 10 amp (minimum) contact rating. Auxiliary and adjustable solid-state time-delay relays. Provide retaining clips with plug-in type relays.
3. Refer to wiring diagrams for specific requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which enclosed controllers and contactors are to be installed and notify Engineer in writing of conditions detrimental to the operation or the proper and timely completion of the Work.

3.2 INSTALLATION

A. General:
1. Install enclosed controllers and contactors at locations indicated on the Drawings.
2. In accordance with Manufacturer's instructions.
3. Comply with NECA 1.
4. Overload elements and settings shall be selected based on motor nameplate ratings.
5. Bundle, train, and support wiring in enclosures.

B. Wall-Mounted Enclosed Controllers and Contactors: Install enclosed controllers and contactors on walls with tops at uniform height, and with disconnect operating handles not higher than 72 inches above finished floor, unless otherwise indicated, and by mounting on channels bolted to wall. For enclosed controllers not at walls, provide free-standing racks complying with Division 26 Section "Hangers and Supports for Electrical Systems."

C. Identification: Label each enclosed controller and contactor with a nameplate complying with the requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:
1. Verify that voltages at controller locations are within 10% of motor nameplate rated voltages.
2. Test each motor for proper phase rotation.
3. Test insulation resistance for each enclosed controller, contactor, component, connecting supply, feeder, and control circuit.
4. Test continuity of each circuit.

END OF SECTION 26 29 13

SECTION 26 29 23 – VARIABLE FREQUENCY MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of variable frequency drives (VFDs).

B. VFDs shall be complete packed systems, engineered to meet the requirements indicated herein and on the Drawings.

C. Reference the Drawings and Division 40 Section “Instrumentation for Process Systems” for additional information related to VFDs.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ANSI/IEEE Standards:
      a. C62.41.1 – Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
      b. C62.41.2 – Recommended Practice on characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
      c. C62.45 – Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits.
      d. 519-2014 – Recommended Practice and Requirements for Harmonic Control in Electric Power Systems.
   2. NEMA Standards:
      a. AB 1 – Molded-Case Circuit Breakers, Molded Case Switches, and Circuit-Breaker Enclosures.
      b. AB 3 – Molded Case Circuit Breakers and Their Application.
      c. ICS 2 – Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
      d. ICS 7 – Adjustable-Speed Drives.
      e. ICS 7.1 – Safety Standards For Construction And Guide For Selection, Installation, And Operation Of Adjustable-Speed Drive Systems.
   3. ANSI/NETA Standards:
      a. ATS – Acceptance Testing Specifications for Electrical Power Equipment and Systems.
   4. NFPA Standards:
      a. 70 – National Electrical Code.
      b. 70E – Standard for Electrical Safety in the Workplace.
   5. Underwriters Laboratory (UL) Standards:
      a. 489 – Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures.
      b. 508 – Standard for Industrial Control Equipment.
      c. 508C – Power Conversion Equipment.
      d. 1449 – Transient Voltage Surge Suppressors.

1.4 SUBMITTALS

A. Shop Drawings: For VFDs.
   1. Name of Manufacturer.
   2. Model number.
   3. Details of construction and installation.
   4. Assembly drawings, including elevations, plans, sections, dimensions, weight, and conduit entry locations.

5. Project Specific Wiring Diagrams:
   a. Diagrams shall clearly identify all field wiring requirements.
   b. Typical diagrams are acceptable for multiple motors controlled in the same manner.
6. Electrical Ratings:
   a. Voltage.
   b. Horsepower.
   c. Interrupt rating.
   d. Enclosure type.
7. Color and finish.
8. Options and accessories.
9. Warranty statement.

B. Installation Instructions: For VFDs.

C. Manufacturer's startup reports to be submitted within 48 hours of completion of startup.

D. Test reports to be submitted within 48 hours of completion of testing.

E. Operation and Maintenance Manuals: For VFDs.
1. Equipment function, normal operating characteristics, and limiting conditions.
2. Assembly, installation, alignment, adjustment, and checking instructions.
3. Operating instructions for startup, routine and normal operating, regulation and control, shutdown, and emergency conditions.
4. Maintenance instructions.
5. Guide to "troubleshooting".
6. Parts lists and predicted life of parts subject to wear.
7. Project specific outline and cross sections, assembly drawings, engineering data, and wiring diagrams. Wiring diagrams shall reflect final, as-installed conditions, and include wire numbers.
8. Test data and performance curves.
9. Manufacturer's startup reports.
10. Test reports.
11. Warranty statement including dates of coverage.
12. Electronic copies of all equipment documentation (i.e., installation instructions, maintenance instruction, project specific wiring diagrams, project specific configuration parameters, etc.) shall be submitted on USB flash drive. Electronic files shall be Acrobat Reader (.PDF) files or AutoCAD (.DWG) files.
13. Configuration Parameters: Provide list of all configurable parameters. Indicate which parameters were changed from default values.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed submittals.

B. VFD Supplier: Provide factory authorized service center within 100 miles of the installation Site.

C. Manufacturer's Services:
1. Provide Manufacturer's field startup service.

D. All VFD assemblies shall be listed and labeled by UL or ETL for compliance with UL 508.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivered materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Store materials indoors and protect from weather. When necessary to store outdoors, elevate materials above grade and enclose with durable, watertight wrapping.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 VARIABLE FREQUENCY DRIVES (VFDs)

A. Manufacturers: All VFDs shall be by the same manufacturer.
   1. Eaton Corporation.
   2. General Electric; ABB.
   3. Rockwell Automation; Allen Bradley.
   4. Schneider Electric; Square D Products.
   5. Siemens USA.

B. General:
   1. VFDs shall be rated for 480 VAC operation and shall provide microprocessor-based control of 3-phase motors. VFDs shall be capable of operating any NEMA Design B squirrel cage induction motor, regardless of manufacturer. VFDs shall be rated for variable torque applications.
   2. VFDs shall utilize pulse width modulation (PWM) technology, converting input voltage and frequency to a variable voltage and frequency output via a 2-step operation. Insulated gate bipolar transistors (IGBTs) shall be used in the inverter section.
      a. The rectifier stage shall convert fixed voltage, fixed frequency, AC line power to a fixed DC voltage. The rectifier shall be insensitive to phase rotation of the AC line. The DC voltage shall be filtered.
      b. The inverter shall change the fixed DC voltage to a variable frequency AC output.
   3. VFD output, actuation, and braking shall be sequenced and coordinated to provide smooth starting and stopping.
   4. Each VFD shall be able to start into a spinning motor by being able to determine motor speed, in any direction, and resume operation without tripping. If the motor is spinning in the reverse direction, the VFD shall start into the motor in the reverse direction, bring the motor to a controlled stop, and accelerate the motor to the required speed. VFDs shall be capable of being run without a connected load.
   5. Separate supply side and load side lugs and terminal blocks shall be provided for power and control wiring connections.

C. Operating Conditions:
   1. Incoming Power: 480 VAC, 3-phase, ± 10%; 60 Hz, ± 5 Hz.
   2. Frequency Stability: ± 0.05% with voltage regulation of ± 1% of maximum rated output voltage.
   3. Speed Regulation: ± 0.5% of base speed.
   4. Load inertia dependent carryover (ride-through) during utility loss. Each VFD shall have a minimum power loss ride-through of 5 cycles.
   5. Insensitive to input phase rotation.
   6. Humidity: 0 to 95%, non-condensing and non-corrosive.
   7. Altitude: 0 to 3,300 feet above sea level.
   8. Ambient Temperature: 0 to 40 degrees C.
   9. Storage Temperature: -40 to 60 degrees C.
   10. To ensure adequate heat dissipation, fan assisted cooling or circulation may be provided such that it does not degrade the enclosure rating.

D. VFD Ratings:
   1. Full load output current rating shall be based on 40 degrees C ambient and 10 kHz switching frequency below 40 HP and 3.6 kHz, 40 HP and above. Upon sensing an over-temperature, VFD shall fold-back switching frequency to reduce operating temperature. VFD shall return to the rated switching frequency after the over-temperature condition has passed.
   2. Each VFD shall have an efficiency that exceeds 95% for loads below 15 HP and exceeds 97% for loads 15 HP and above. Efficiency shall exceed 90% at 50% speed and load.
   3. Each VFD shall maintain a line side displacement power factor at no less than 0.95, regardless of speed and load.
   4. VFD shall have a 1-minute overload current rating at 120% for variable torque applications; 150% for constant torque applications.
   5. Each drive shall be able to provide rated motor torque at 0.5 Hz.
   6. Each VFD and its components shall be housed in a NEMA 12 enclosure, unless indicated otherwise on the Drawings.

7. Output frequency of each drive shall be adjustable from 0-400 Hz.
8. Each VFD shall include automatic slip compensation.
9. Each VFD shall be rated for 42K AIC (minimum).

E. Protection:
1. Each VFD shall include protection against short circuits between output phases, between output phases and ground, on the output, on the internal supplies, and on the logic and analog outputs.
2. Each VFD shall have an auto restart function which will provide up to 5 restart attempts on a fault condition other than a ground fault, short circuit, or internal fault. A programmable time delay before restart attempt from 1 to 600 seconds shall be included.
3. Deceleration shall be programmable for normal and fault conditions.
4. Upon loss of analog input, the VFD shall indicate a fault and be capable of being programmed to operate at a user defined speed.
5. Solid state I^2t protection shall be included that is adjustable from 45 to 105% of the current output of the drive. The protection shall be UL listed and meet UL 508C as Class 10/20 overload protection.
6. Each VFD shall have a thermal switch with an adjustable prealarm that will provide a minimum of a 60 second delay before an over temperature fault.
7. Each VFD shall include a programmable fold-back function that will anticipate controller over temperature and/or overload conditions and fold back the output frequency to avoid fault conditions.
8. The internal power supply shall include protection from incorrect connection and shorting. Logic outputs shall be current limited and shall not be damaged from shorting or excess current draw.
9. Each VFD shall include the following protective features:
    a. Overcurrent.
    b. Overvoltage.
    c. Phase rotation insensitive.
    d. Input phase loss.
    e. Input overvoltage.
    f. Line surge.
    g. Output short circuit.
    h. Output ground fault.
    i. Output phase loss.
    j. Over-temperature.
    k. DC overvoltage.
    l. Drive overload.
    m. Motor overload.
    n. Motor underload.
    o. Inverter fault.
    p. Motor high winding temperature (temperature switch(es) wired to VFD as a discrete input).
    q. Selectable automatic restart after power loss or on resettable trip.
    r. Stall protection (0% to 200%, 2 to 120 seconds).
    s. Microprocessor failure.
10. Each VFD shall provide ground fault protection during power-up, starting, and running.
11. Each VFD shall include internal diagnostics for valid operation of memory, option module, loss of analog input, communications loss, dynamic brake failure, power supply failure, and loss of control power. VFD run status and fault types shall be recorded in each drive's memory for the past 9 faults (minimum). On a fault, the VFD shall shut down without damage to itself or other non-faulted equipment.
12. Each drive shall provide Class 10/20 overload protection.
13. Each VFD shall be provided with a conformal coating applied to all sensitive electrical components.

F. Adjustments and Configurations:
1. Three types of acceleration and deceleration ramps shall be available to be programmed into the VFD: linear, S curve and U curve. Acceleration and deceleration ramp times shall be adjustable from 0.1 to 3,000 seconds.
    a. VFDs shall include two-part ramps for starting (acceleration) and stopping (deceleration). For starting, VFD shall be able to ramp quickly from 0 to an operator adjustable speed or percentage, then ramp from that speed to the desired operating speed in an operator adjustable time period. For stopping, VFD shall ramp from operating speed to an operator adjustable speed or percentage in an operator adjustable time period, then ramp quickly from that speed to 0.
2. Each VFD shall be able to be programmed for open loop sensorless vector or V/Hz frequency control mode.

3. The volts per frequency (V/Hz) ratios shall be user selectable to meet various torque applications. The V/Hz output shall not be affected or require readjustment when other drive adjustments (such as maximum speed) are changed.
4. For variable torque applications, the VFD shall include a no-load function that allows the voltage to the motor to be reduced. A constant V/Hz will be maintained during acceleration. The output voltage will then automatically adjust to meet the torque requirements of the load.
5. Each VFD shall include slip compensation.
6. Three skip frequency ranges (for critical frequency avoidance) shall be provided with selectable 2 or 5 Hz bandwidths. The skip frequencies shall be able to be programmed independently, back to back or overlapping.

G. Operator Interface:
1. A door mounted operator interface (OI) panel shall be included with each VFD. The panel shall be an alphanumeric, LCD display panel with a terminal keypad and status indicators. From the panel, an operator shall be able to view and/or adjust all configuration, programming, diagnostic, and operating parameters and I/O assignments. Access to configuration parameters shall be protected to prevent unauthorized adjustments. Operator interface panel shall be accessible without having to open the enclosure.
2. Each VFD shall include indicator for VFD power ON and other conditions as specified herein.

H. Control:
1. Each VFD shall be capable of interfacing with external pilot devices for starting/stopping, speed control, and operational status.
2. Control power shall be supplied from an internal power supply (120VAC or 24VDC). Power supply shall be sized to supply power to auxiliary devices as required. Interposing relays shall be provided as required to be compatible with signal wiring. Coordinate signal voltages with existing field devices interfacing with VFD.
3. Each VFD shall include a minimum of 5 programmable digital inputs, 2 analog inputs (operator selectable for 0-20 mA, 4-20 mA, 20-4 mA, 0-5 V, 1-5 V, or 0-10 V), 3 programmable relay (Form C) outputs, and 2 analog outputs (operator selectable for 0-20 mA, 4-20 mA, 20-4 mA, 0-5 V, 1-5 V, or 0-10 V). The analog outputs shall be able to be programmed to be proportional to frequency, current, power, torque, or voltage. Additional I/O shall be provided as required to achieve functionality as indicated on drawings and described herein.
4. Refer to wiring diagrams for specific control device requirements. Equipment Suppliers are responsible for coordinating control devices required by respective equipment.
5. The following door mounted devices shall be provided:
    a. Local-Off-Remote maintained position, 22.5mm selector switch, equal to Allen-Bradley 800MR. Auxiliary contact on the Local-Off-Remote selector switch to provide indication that the switch is in the Remote position.
    b. Elapsed time indicator, synchronous motor type, 5/32-inch minimum display size.
    c. Push-to-Test, 22.5mm, LED type, green RUNNING indicating light, equal to Allen-Bradley 800MR.
    d. Push-to-Test, 22.5, LED type, red VFD FAULT indicating light, equal to Allen-Bradley 800MR.
    e. Reset pushbutton, equal to Allen-Bradley 800MR.
    f. Speed indication meter, where required to meet functional requirements.
    g. Speed potentiometer, where required to meet functional requirements.
6. Door mounted devices shall be mounted between 40 inches and 60 inches above finished floor or grade.

I. Accessories:
1. Circuit breaker disconnect to disconnect all incoming AC power. Handle position shall indicate ON, OFF, and TRIPPED conditions. Disconnect shall be interlocked to prevent unauthorized opening/closing of the VFD door with the handle in the ON position. Interlock shall be defeatable. Disconnect shall be lockable.
2. Ethernet/IP Ethernet Communication Module. Coordinate communication module with SCADA system architecture and system component manufacturers.
3. Provide circulating fan(s) of size and quantity as required. Fans shall be thermostatically or otherwise controlled and have a delayed off time feature (set to turn fan(s) off 20 minutes after VFD shuts down). Fans shall not run constantly.
4. Heavy duty, industrial control relays with tubular pin terminal, pure silver contacts, and IP20 sockets, quantity as required.

J. Warranty: Manufacturer shall provide a comprehensive, on-site product warranty, including parts, labor and travel expenses, for a period of not less than 3 years from date of installation

2.2 HARMONIC DISTORTION MITIGATION

A. VFDs shall limit harmonic distortion reflected onto the power distribution system to the voltage and current levels defined by IEEE 519.

B. VFDs shall utilize 6-pulse with an active front end harmonic filter.

C. Provide a 5% input line reactor (minimum) with each VFD.

2.3 SPARE PARTS

A. 1 set of fuses for each size and type provided.

B. 1 set of MOVs.

C. 1 set of fan(s).

D. 2 sets of control power fuses for each size and type provided.

E. 2 pilot lights of each type provided.

F. 1 keypad for each type provided.

G. 2 sets of filters (for fans/ventilation).

2.4 SHAFT GROUNDING RINGS (SGRs) AND HIGH FREQUENCY BONDING

A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.

B. Motors up to 100 HP shall be provided with one shaft grounding ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated, and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer or contractor and shall be installed in accordance with the shaft grounding ring manufacturer's recommendations.

C. All motors operated on variable frequency drives shall be bonded from the motor foot to system ground with a high-frequency ground strap made of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection. Provide AEGIS HF Ground Straps, or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all required motor overloads sized in accordance with motor nameplate FLA.

B. Locate VFD as indicated on the Drawings.

C. Ensure unrestricted access to ventilation for VFD.

D. Install all free-standing, floor-mounted VFDs on a concrete housekeeping pad.

E. Separate line, load, and control conductors per the Manufacturer's instructions (in separate conduits).

F. Reference Manufacturer's literature for any special grounding requirements.

3.2 SHAFT GROUNDING RINGS

A. Shaft grounding rings (SGR) shall be factory installed inside the motors by the manufacturer wherever possible. SGRs may be field installed by installing contractor subject to Engineer's approval. Provide AEGIS SGR Colloidal Silver Shaft Coating, or approved equal, on shafts prior to rings installation, in accordance with SGR manufacturer's recommendations, after first cleaning shafts.

B. Install and test SGRs in accordance with manufacturer's recommendations. Install the SGR so that the aluminum frame maintains an even clearance around the shaft. Conductive microfibers shall be in full circumferential contact with conductive metal surface of the shaft. Do not use thread lock to secure the mounting screws as it may compromise the conductive path to ground. If thread lock is required, use a small amount of EP2400 AEGIS Conductive Epoxy, or approved equal, to secure the screws in place.

C. Shafts shall be clean and free of any coatings, paint, or other nonconductive material (clean to bare metal). Depending upon the condition of the shaft, it may require using emery cloth or Scotch-Brite. If the shaft is visibly clean, a non-petroleum-based solvent may be used to remove any residue. Check the conductivity of the shaft using an ohm meter. Ohms test: Place the positive and negative meter leads on the shaft at a place where the microfibers will contact the shaft. Each motor will have a different reading but in general one should have a maximum reading of less than 2 ohms. If the reading is higher, clean the shaft again and retest.

D. After motors with SGR are fully installed in the field (in equipment, assemblies, or individually), for both factory-installed-SGR and field-installed-SGR cases, test for a conductive path to ground using an Ohm meter. Place one probe on metal frame of SGR and one probe on motor frame. Motor must be grounded to common earth ground with variable frequency drive according to applicable standards. Verify that SGR installations and test readings comply with SGR manufacturer's requirements.

3.3 HIGH-FREQUENCY BONDING

A. All motors operated on variable frequency drives shall be bonded from the motor foot to system ground with a high-frequency ground strap made of flat braided, tinned copper with terminations to accommodate motor foot and system ground connection. Provide AEGIS HF Ground Straps, or equal. After motors with SGR are fully installed in the field (in equipment, assemblies, or individually), for both factory-installed-SGR and field-installed-SGR cases, test for a conductive path to ground using an Ohm meter.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Arrange and pay for Manufacturer's engineer to provide the services indicated below for a minimum onsite time of 1 day, or as needed to completely startup and commission all VFDs in accordance with the Manufacturer's instructions. Provide individual startup and testing reports for each VFD. Schedule the following as soon as practicable after installation and at times approved by Engineer and Owner.
   1. Manufacturer's Engineer:
      a. Check work.
      b. Configure, program, and commission VFDs. Coordinate with startup schedule of related equipment.
      c. Assist in startup and modify configuration parameters as required to coordinate equipment operation with SCADA controls.
      d. Demonstrate operation and maintenance to Owner's personnel.
      e. Review operation and maintenance manual with Owner's personnel. Two 2-hour review sessions shall be scheduled to coordinate with schedules of Owner's personnel (i.e., day/morning and afternoon/evening shifts). Each review session shall accommodate up to 8 individuals. Submit detailed outline for each review session prior to scheduling. Owner reserves the right to record review sessions. Recording will be done by Owner.
      f. Adjust device configuration parameters as required. All drive parameters shall be documented and included in the operations and maintenance manuals and startup reports.

B. Promptly make all changes and additions required by Manufacturer's engineer.

C. Refer to Division 26 Section “Electrical Testing” for additional testing requirements.

END OF SECTION 26 29 23

SECTION 31 10 13 – SITE PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the major items listed below:
   1. Clearing Site of above-grade trees, shrubs, grass and plant life.
   2. Removal of the following man-made items:
      a. Walls.
      b. Fences.
      c. Sheds.
      d. Similar improvements as indicated on the Drawings.
   3. Removal of roots and stumps.
   4. Removal of exposed rocks, boulders and debris.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following:
   1. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 DEFINITIONS

A. Terms: Surface Improvements: Pavement, walks, drives, curbs, curb and gutter, improved lawns, monuments, property irons, reference points and similar improvements.

1.5 SUBMITTALS

A. Permit to Store or Dump Removed Materials:
   1. On property owned, leased or occupied by someone other than Owner.
   2. Submit prior to storing or dumping.
   3. Permit shall absolve Owner from responsibility for storing or dumping.

1.6 QUALITY ASSURANCE

A. Trimming: Trimming of limbs and branches and the painting of tree wounds shall be actively supervised by a member of one of the following:
   1. ASCA - American Society of Consulting Arborists.
   2. ISA - International Society of Arboriculture.
   3. NAA - National Arborist Associations.

B. Interference:
   1. Ensure that Site preparation work does not unduly interfere with pedestrian and vehicular traffic.
   2. Obtain Engineer's and governing authority's approvals prior to closing a public street.

1.7 PROJECT CONDITIONS

A. Burning: Not permitted.

B. Burial: Not permitted.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PREPARATION

A. Soil Erosion Control: Provide soil erosion control in accordance with Division 31 Section “Erosion and Sedimentation Controls” prior to starting Site preparation work.

B. Protection of Trees and Shrubs:
   1. Protect trees and shrubs which are to remain from permanent damage by construction operations.
   2. Prevent vehicles from driving within area under dripline of trees which are to remain.

C. Maintain designated temporary roadways, walkways, and detours for vehicular and pedestrian traffic.

3.2 APPLICATION

A. Clearing:
   1. Remove items requiring removal under this Section from building area, right-of-way and easements, and proposed pavement area.
   2. Remove roots, rocks and boulders to a depth of 2 feet below finish grade in the following areas:
      a. Proposed buildings or structures.
      b. Proposed pavements and walks.
      c. Other areas where compaction of the subgrade is required.

B. Removal of Sod: Cut to a straight line at the expected excavation limits with sod cutter.

C. Prevent Construction Operations from Damaging or Disturbing:
   1. Trees or roots of trees which are to remain.
   2. Surface improvements which are to remain.

3.3 DISPOSAL OF EXCESS MATERIAL

A. General:
   1. Remove and properly dispose of all material not needed to complete Project.
   2. Dispose of excess material at a location off the Site.
   3. Dispose of excess topsoil at a location off the Site.
   4. Disposal of materials shall not violate laws, rules, regulations and the like regarding the filling of flood plains, wetlands and other environmentally sensitive areas.
   5. Provide adequate controls to maintain disposal sites in a neat and safe conditions by periodic leveling of material, the control of erosion and such other practices as are necessary.

END OF SECTION 31 10 13

SECTION 31 22 00 – GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Excavation.
   2. Cutting and filling.
   3. Rough and finish grading.
   4. Disposal of excavated materials.
   5. Topsoil.
   6. Excess water control.
   7. Pavement subgrade.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. AOAC - Association of Official Agricultural Chemists: Methods of Testing.
   2. ASTM Standards:
      a. D422 - Method for Particle-Size Analysis of Soils.
      b. D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort.
      c. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
      d. D2487 - Classification of Soils for Engineering Purposes.
   3. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 DEFINITIONS

A. Terms:
   1. Driving Surface: A pavement, curb, or sidewalk.
   2. Excavation:
      a. Removing the following materials from their present location:
         1) Native below-grade material such as soil, rocks, boulders less than 1/2 cubic yard in volume, and buried trees.
         2) Man-made items such as, but not necessarily limited to:
            a) Bituminous and concrete paving.
            b) Curbs.
            c) Riprap.
            d) Head walls.
            e) Underground utilities.
            f) Manholes and catch basins.
            g) Foundations.
            h) Sidewalks.
   3. Fill: Soil, native material, imported material or other material which is placed over the subgrade, or excavated areas; under roadways, parking areas, walks, buildings, or structures; and anywhere else on the Site.
   4. Grading: The act of moving soil from one location on the Site to another to achieve the contours and elevations as indicated on the Drawings and as herein specified.
   5. Hardpan:
      a. Cemented soil layers.
      b. Is not hard clay layers that are not cemented.

6. Imported Material: Soil material which is purchased by Contractor and hauled onto the Site.
7. Native Material: Soil and other natural earth materials, except rock, which are existing on the Site prior to the start of Work.
8. Pavement: Any combination of subbase, base course and concrete, bituminous or aggregate surface course, including shoulders, placed on a subgrade. Includes roadways, parking areas, driveways, and bituminous seal coat.
9. Rock Excavation:
   a. Excavation of igneous, metamorphic or sedimentary rock or hardpan which cannot be excavated without continuous drilling or blasting or continuous use of a ripper or other special equipment.
   b. Excavation of boulders of 1/2 cubic yard or more in volume.
10. Structure: A building, retaining wall, tank, footing, slab, or other similar construction.
11. Subbase: The layer of material placed on the subgrade as part of the pavement structure.
12. Subgrade:
   a. Below structures and below fill on the Site: The top elevation of the undisturbed native material after all topsoil is stripped off and excavation is completed.
   b. Below driving surfaces: The bottom elevation of the subbase.
13. Surface Improvement: All improvements beyond what might be encountered in an open unimproved field.
14. Undercut: Excavation of native material from below the bottom of footings, floors, structures, and subbases.
15. Utility Structure: Manhole, catch basin, valve chamber, junction chamber, water main valve, or other similar utility appurtenance.
16. Other Definitions: Other earthwork terms not defined in the Contract Documents shall be as defined in state DOT Standard Specifications for Construction.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Quantities: Determine the required quantities of all earthwork materials and operations and use as the basis for the lump sum Bid.

1.6 QUALITY ASSURANCE

A. Testing will be performed in accordance with Division 01 Section “Testing Services for Buried Utilities, Roadways, and Site Projects” and the Contractors Quality Control Plan.

B. Compaction:
   1. Predominately Granular Soils:
      a. Density shall be determined by using the modified Proctor method, ASTM D1557.
      b. Compact fill to at least 95% maximum density.
      c. The first 12 inches of subgrade below all driving surfaces, structures, utility structures, and fill on the Site:
         1) Shall be tested for density.
         2) Compact to at least 95% maximum density if the existing density is below 95%.
   2. Predominately Cohesive Soils:
      a. Density shall be determined by using the standard Proctor method, ASTM D698.
      b. Compact fill to at least 98% maximum density.
      c. The first 12 inches of subgrade below all driving surfaces, structures, utility structures, and fill on the Site:
         1) Shall be tested for density.
         2) Compact to at least 98% maximum density if the existing density is below 95%.

1.7 PROJECT CONDITIONS

A. Dust Control:
   1. Use all legal means necessary to control dust on and near the Work and on and near all off-site borrow areas if such dust is caused by Contractor's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.

2. Treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every Friday afternoon, or more often as necessary if directed by Engineer. Utilize vacuum if dust from brooming is excessive in opinion of Engineer.

B. Existing Structures, Utility Structures, and Utilities:
1. Call MISS DIG to locate all existing underground utilities prior to starting excavation.
2. Where utilities, utility structures, or structures are encountered which are in active use:
   a. Provide adequate protection for them.
   b. Be responsible for damages to them.
3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours notice to the affected occupants of the time and duration of the anticipated shut off.
5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
6. Raise, lower, or move underground utilities, utility structures, or structures which interfere with the utility, utility structure, or structure being constructed as part of this Work.

C. Special Filling Requirements:
1. Comply with the regulations of the state DOT, county road, and railroad company engineering departments with regard to placing fill and compaction in their respective rights-of-way.
2. Obtain necessary permits for filling activities off Site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. Approval Required: All material shall be subject to the approval of Engineer or independent testing laboratory.
2. Notification: For approval of imported material, notify Engineer or independent testing laboratory at least 1 week in advance of intention to import material, designate the proposed borrow area, and permit Engineer or independent testing laboratory to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

B. Material Sources and Uses:
1. Imported Material:
   a. Fill in undercut.
   b. Fill below structures, utility structures, or driving surfaces.
   c. Stone stabilization course.
   d. Topsoil.
2. Native material, unless quantity is not sufficient; then shall be imported material.
   a. Fill not below structures, utility structures, or driving surfaces.

C. Fill In Undercut: MDOT 902, Granular Material Class II.

D. Fill below structures, utility structures, or driving surfaces: MDOT 902, Granular Material Class II.

E. Stone Stabilization Course:
1. Crushed Stone: 1-1/2 inches maximum size.
2. Filter Fabric:
   a. By Mirafi; Amoco; Exxon; Nicolon; or equal.
   b. Monofilament polypropylene woven fabric.
   c. Equivalent opening size of 70.

F. Fill Not Below Structures, Utility Structures, or Driving Surfaces:
   1. Native material.
   2. Exclusive of gray or blue clay, peat, organic matter, or frozen lumps.
   3. Containing no rocks or lumps over 3 inches in greatest dimension.
   4. Obtain approval for using native material as fill from Engineer or independent testing laboratory.

G. Topsoil:
   1. Fertile, friable soil, containing a minimum of 2.5% and maximum 12% of organic matter as determined by the Loss on Ignition Test, AOAC, with not more than 50% clay and not more than 55% sand as determined in accordance with ASTM D422.
   2. At least 90% of the material shall pass the No. 10 sieve.
   3. Topsoil shall be free of refuse or all material toxic to plant growth. Ensure that the topsoil is contamination-free and clean at the source prior to transport to Site.
   4. Topsoil shall be free of subsoil and stumps, roots, brush, stones or similar objects larger than 1-inch diameter.
   5. Ordinary sods and herbaceous growth, like grass, need not be removed, but shall be thoroughly broken up and intermixed with soil during handling operations.
   6. Topsoil, unless otherwise specified or approved, shall have, according to Methods of Testing by the AOAC, acidity range of approximately 5.5 pH to 7.6 pH or as approved by Engineer prior to delivery.

2.2 OTHER MATERIALS

A. All other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by Contractor subject to the approval of Engineer or independent testing laboratory.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Topsoil:
   1. Remove all topsoil to depth at which subsoil is encountered, from all areas under buildings, driving surfaces, and from all areas which are to be cut to lower grades or filled.
   2. With Engineer's approval, topsoil to be used for finish grading may be stored on the Site.
   3. Other topsoil may be used for fill in noncritical areas with approval of Engineer.

B. Obstructions:
   1. Remove and dispose of buried trees, rocks, boulders, driving surfaces, pipes and the like, as required for the performance of the Work.
   2. Exercise care in excavating around catch basins, inlets, and manholes.
   3. Avoid removing or loosening castings or pushing dirt into utility structures.
   4. Repair or replace damaged or displaced castings; remove dirt entering utility structures during the performance of the Work at no additional cost to Owner.

C. Cutting Paved Surfaces and Similar Improvements:
   1. All cuts shall be a minimum of 1-foot wider than trench on each side. When the remaining width of paved surface is less than 4 feet, remove the entire paved surface.
   2. Before removing pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks the width of the trench.
   3. Concrete:
      a. Pavements: Saw cut if over 3 feet from expansion or construction joint, otherwise remove to joint.
      b. Sidewalks: Remove to joints.
      c. Curb and gutter: Remove to joints.
   4. Final surface Course Bituminous: Saw cut joints unless otherwise approved by Engineer.
   5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
   6. Contractor may tunnel under curbs that are encountered. Replace curb disturbed by construction.
   7. Dispose of materials removed.

D. Utilities To Be Abandoned:
   1. When pipes, conduits, sewers, or other utilities or utility structures are removed from the excavation leaving dead ends in the ground, fully plug such ends with brick and mortar.
   2. Entirely remove abandoned utility structures unless otherwise specified or indicated on the Drawings.
   3. Remove from the excavation all materials which can be readily salvaged and store at a location designated by Owner.
   4. All salvageable materials will remain the property of Owner unless otherwise indicated by Owner.

E. Undercut:
   1. If soft material, which in the opinion of Engineer or independent testing laboratory is not suitable, is encountered below a structure, utility structure, or driving surface, Engineer may order the removal of this soft material and its replacement with specified material in order to make a suitable foundation for the construction of the structure, utility structure, or driving surface.
   2. All undercutting made at the order of Engineer will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
   3. No extra payment will be made if removal is required as a result of poor dewatering techniques.
   4. Undercutting which is specifically indicated on the Drawings or herein specified, shall be included in the base Bid.
   5. Soil removed may be used as fill in areas not below driving surfaces, structures, or utility structures.
   6. Compact subgrade at bottom of undercut prior to placing fill.
   7. Place and compact specified fill in undercut.
   8. Lateral extent of undercut shall be a horizontal distance equal to the depth of undercut below structure, utility structure, or driving surface.

F. Excavating:
   1. All excavation shall be by open cut from the surface except as herein specified or as indicated on the Drawings.
   2. If required because of excess water conditions, place stone stabilization course prior to proceeding with construction. Place filter fabric over stone stabilization course.

G. Rock Excavation:
   1. Notify Engineer prior to removal if rock is encountered.
   2. Where rock is encountered within the excavation, expose the surface of the rock sufficient to permit adequate measurements to be taken before the rock excavation is started.

3.2 FILL

A. General:
   1. Do not place fill until the subgrade been examined by Engineer or independent testing laboratory.
   2. Place fill in even layers not exceeding 10 inches in depth and thoroughly compact as herein specified.
   3. Do not place additional fill until compaction on a lift complies with specification requirements.
   4. If an analysis of the soil being placed shows a marked difference from 1 location to another, the fill being placed shall not be made up of a mixture of these materials.
   5. Handle each different type of material continuously so that field control of moisture and density may be based upon a known type of material.
   6. Do not place fill following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.
   7. Do not place fill on frozen subgrade.

B. Compaction:
   1. Select compaction equipment to achieve the required compaction without damaging adjacent structures, utility structures, or driving surfaces.
   2. Suggested Equipment Selections:
      a. If soil is predominantly granular, use pneumatic tired or vibratory drum rollers loaded to not less than 325 pounds in accordance with rated inch of tire width.

b. For clay fills, compact each layer with sheepsfoot rollers. Rollers shall have staggered rows of feet projecting not less than 7 inches from drum and shall be loaded to produce at least 200 pounds per square inch of tamping area in contact with the ground.
c. Compact around structures and utility structures with hand operated vibrating compactors for granular soils and Barco rammer type compactors for clay soils.

C. Moisture:
1. Compact all fill with the moisture content as specified.
2. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.
3. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

3.3 GRADING

A. General:
1. Perform all rough and finish grading required to attain the elevations indicated on the Drawings.
2. Perform rough grading to an accuracy of ± 0.10 feet.
3. Perform finish grading to an accuracy of ± 0.05 feet.
4. Comply with all excavating and fill requirements specified herein during grading operations.

B. Grading Around Buildings: Control the grading around buildings so the ground is pitched to prevent water from running into the excavated areas of a building or damaging other Site features.

C. Treatment After Completion of Grading:
1. After grading is completed, permit no further excavation, filling, or grading, except with the approval of Engineer.
2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

D. Topsoil: All graded areas, outside of buildings and driving surfaces, shall receive 4 inches of topsoil.

3.4 EXCESS WATER CONTROL

A. Regulations and Permits: Comply with soil erosion control permits in accordance with Mich. P.A. 451, Part 91 of 1994, the Natural Resource and Environmental Protection Act, and all pertinent rules, laws, and regulations.

B. Unfavorable Weather:
1. Do not place, spread, or roll any fill material during unfavorable weather conditions.
2. Do not resume operations until moisture content and fill density are satisfactory to Engineer or independent testing laboratory.

C. Pumping and Drainage:
1. Provide, maintain, and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.
2. Dewater by means which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil. Use wells, portable pumps, temporary underdrains or other methods as is necessary.
3. Perform Pumping and Drainage:
a. In such a manner to cause no damage to property or structures and without interference to the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors.
b. In accordance with all pertinent laws, rules, ordinances and regulations.
4. Do not overload or obstruct existing drainage facilities.
5. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

3.5 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. General:
   1. Remove and properly dispose of all excavated material not needed to complete filling and grading.
   2. Dispose of excess excavated material at a location off the Site.
   3. Dispose of excess topsoil at a location off the Site.
   4. Disposal of all materials shall not violate laws, rules, regulations and the like regarding the filling of flood plains, wetlands and other environmentally sensitive areas.
   5. Provide adequate controls to maintain disposal sites in a neat and safe conditions by periodic leveling of material and such other practices as are necessary.
   6. Provide all soil erosion control measures necessary to prevent soil erosion and sedimentation of wetlands, rivers, ditches, or similar low lying areas.

3.6 CLEANUP

A. Upon completion of the work of this Section, remove all excess excavated material, trash, and debris resulting from construction operations. Remove equipment and tools. Leave the Site in a neat and orderly condition acceptable to Engineer, and in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 31 22 00

SECTION 31 23 03 – EXCAVATION AND FILL FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Excavation and trenching in earth and in rock.
   2. Disposal of items from clearing and unsuitable or excess excavated materials.
   3. Complete drainage of excavations.
   4. Temporary or permanent sheeting, bracing and shoring of excavations.
   5. Installation of normal and special foundations, bedding and backfill materials.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standard Specifications:
      a. D1556 - Density and Unit Weight of Soil In Place by the Sand-Cone Method.
      b. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
      c. D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
      d. D2922 - Density of Soil and Soil-Aggregate in Place by Nuclear Methods.
   2. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 DEFINITIONS

A. Terms:
   1. Bedding: The material placed around a utility between 4 inches below to 12 inches above the utility the full width of the trench.
   2. Driving Surface: A pavement, curb, or sidewalk.
   3. Excavation:
      a. Removing the following materials from their present location:
         1) Native below-grade material such as soil, rocks, boulders less than 1/2 cubic yard in volume, and buried trees.
         2) Man-made items such as, but not necessarily limited to:
            a) Bituminous and concrete paving.
            b) Curbs.
            c) Riprap.
            d) Head walls.
            e) Underground utilities.
            f) Manholes and catch basins.
            g) Foundations.
            h) Sidewalks.
   4. Extra Earth Excavation: Excavation of native material from below the normal trench bottom.
   5. Foundation Material: The material placed in a trench undercut to replace extra earth excavation.
   6. Hardpan:
      a. Cemented soil layers.
      b. Is not hard clay layers that are not cemented.
   7. Imported Material: Soil material which is purchased by Contractor and hauled onto the Site.
   8. Native Material: Soil and other natural earth materials, except rock, which are existing on the Site prior to the start of Work.

9. Normal Trench Bottom: The surface of the undisturbed native material at an elevation 4 inches below the bottom of the utility.
10. Pavement: Any combination of subbase, base course and concrete, bituminous or aggregate surface course, including shoulders, placed on a subgrade. Includes roadways, parking areas, driveways, and bituminous seal coat.
11. Rock Excavation:
    a. Excavation of igneous, metamorphic or sedimentary rock or hardpan which cannot be excavated without continuous drilling and blasting or continuous use of a ripper or other special equipment.
    b. Excavation of boulders of 1/2 cubic yard or more in volume.
12. Special Foundations:
    a. Specially constructed systems for support of underground utilities such as timber piling, concrete foundations and surcharge techniques.
    b. Extra earth excavation and placing imported or native materials are not special foundations.
13. Structure: A building, retaining wall, tank, footing, slab, or other similar construction.
14. Suitable Material:
    a. Native material excavated from the trench and approved as backfill by Engineer or independent testing laboratory.
    b. Not used under or within 1 on 1 slope of driving surfaces or structures.
    c. Placed between the top of the bedding or trench backfill as indicated on the Drawings and the bottom of the surface restoration.
15. Trench Backfill:
    a. The material placed between the top of bedding and the bottom of suitable material, the surface restoration or driving surface, as indicated on the Drawings.
    b. Used under and within 1 on 1 slope of driving surfaces or structures.
16. Utility Structure: Manhole, catch basin, valve chamber, junction chamber, water main valve, or other similar utility appurtenance.
17. Other Definitions: Other earthwork terms not defined herein or in the Contract Documents shall be as defined in state DOT Standard Specifications for Construction.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Trench Bottom Suitability:
1. Be responsible for the suitability of the normal trench bottom in supporting the utility, bedding and backfill.
2. Notify Engineer and await Engineer's decision if a possible unsuitable condition exists.
3. Poor dewatering techniques or lack of excess water control shall not be a reason for additional payment for remedial measures.

B. Trench Wall Stability:
1. Be responsible for the trench configuration, including sheeting, shoring and bracing necessary to support trench side walls from collapsing.
2. Be responsible for the structural design and stability of a pipe-laying box if utilized on the Project to prevent trench walls from collapsing.

1.6 QUALITY ASSURANCE

A. Testing: Testing will be performed in accordance with Division 01 Section "Testing Services for Buried Utilities, Roadways, and Site Projects." and the Contractor’s Quality Control Plan.

B. Compaction:
1. Determine density by the modified Proctor method, ASTM D1557.
2. Compact granular trench backfill and bedding to at least 95% maximum density.
3. Compact suitable backfill material to at least 90% maximum density.
4. The first 12 inches of native material at the bottom of utility trenches:
    a. Test for density.
    b. Compact to at least 95% maximum density (modified proctor) if the existing density is below 95% maximum density (MP).
    c. Compact clay soil to at least 98% maximum density in accordance with standard proctor ASTM D698, if below 98% maximum density (SP).

1.7 SUBMITTALS

A. Action Submittals: For imported materials:
   1. Source.
   2. State DOT classification.
   3. Sieve Analysis.

1.8 PROJECT CONDITIONS

A. Dust Control:
   1. Use all legal means necessary to control dust on and near the Work and on and near off-site borrow areas if such dust is caused by Contractor's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Moisten or otherwise treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
   3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every Friday afternoon, or more as necessary if directed by Engineer. Utilize vacuum if dust from brooming is excessive in opinion of Engineer.

B. Existing Structures, Utility Structures, and Utilities:
   1. Call MISS DIG to locate existing underground utilities prior to starting excavation.
   2. Where utilities, utility structures or structures are encountered which are in active use:
      a. Provide adequate protection for them.
      b. Be responsible for damage to them.
   3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
   4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours notice to the affected occupants of the time and duration of the anticipated shutoff.
   5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
   6. Raise, lower, or move underground utilities, utility structures or structures which interfere with the utility or utility structure being constructed as part of this Work.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
   1. Approval Required: Material shall be subject to the approval of Engineer or independent testing laboratory.
   2. Notification: For approval of imported material, notify Engineer or independent testing laboratory at least 1 week in advance of intention to import material, designate the proposed borrow area, and permit Engineer or independent testing laboratory to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

B. Material Sources and Uses:
   1. Imported Material:
      a. Foundation material.
      b. Bedding.
      c. Pea stone.
      d. Trench backfill.
   2. Native material unless quantity is not sufficient; then shall be imported material: Suitable material.

C. Foundation Material for Crushed Stone: 1-1/2-inch maximum size.

D. Bedding:
   1. For Pipes Less Than 36 Inches:
      a. MDOT 902 Granular Material Class II modified to 100% passing a 1/2-inch sieve.
   2. For Pipes 36 Inches and Larger:
      a. Pea stone bedding to spring line.
      b. Geotextile filter fabric over pea stone.

c. MDOT Granular Material Class II to 1 foot above pipe.

3. For Utility Structures:
   a. Sand gravel fill of such gradation that 100% will pass a 1/2-inch sieve and not more than 10% by weight is lost by washing, or
   b. MDOT 902 Granular Material Class II modified to 100% passing a 1/2-inch sieve.

E. Pea Stone: Clean stone with 100% passing a 3/8-inch sieve and 100% being retained on a No. 8 sieve.

F. Trench Backfill: MDOT 902 Granular Material Class II.

G. Suitable Material:
1. Native Material Which is Used as Backfill:
   a. Exclusive of gray or blue clay, peat, organic matter, or frozen lumps.
   b. Containing no rocks or lumps over 3 inches in greatest dimension.
   c. Having a moisture content such that material is capable of being compacted to 90% maximum density.
2. MDOT 902 Granular Material Class II if native material is not adequate in opinion of Engineer.

2.2 OTHER MATERIALS

A. Other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by Contractor subject to the approval of Engineer or independent testing laboratory.

PART 3 - EXECUTION

3.1 GENERAL

A. Excavating, Backfilling and Compacting:
1. For Structures: In accordance with Division 31 Section “Excavation and Fill for Structures.”
2. For Utility Structures: In accordance with this Section.

B. Obstructions:
1. Remove and dispose of buried trees, rocks, boulders, driving surfaces, pipes and the like, as required for the performance of the Work.
2. Exercise care in excavating around catch basins, inlets and manholes.
3. Avoid removing or loosening castings.
4. Repair and replace damaged or displaced castings; remove dirt entering utility structures during the performance of the Work at no additional cost to Owner.

C. Cutting Paved Surfaces and Similar Improvements:
1. Cut pavement prior to excavating.
2. Cuts shall be a minimum of 1-foot wider than trench on each side. When the remaining width of paved surface is less than 4 feet, remove the entire paved surface.
3. Before removing pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks the width of the trench.
4. Concrete:
   a. Pavements: Saw cut if over 3 feet from expansion or construction joint, otherwise remove to joint.
   b. Sidewalks: Remove to joints.
   c. Curb and Gutter: Remove to joints.
5. Final Surface Course Bituminous: Saw cut joints unless otherwise approved by Engineer.
6. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement.
7. Contractor may tunnel under curbs that are encountered. Replace curb disturbed by construction.
8. Dispose of materials removed.

D. Utilities to be Abandoned:
1. When pipes, conduits, sewers or utility structures are removed from the trench leaving dead ends in the ground, fully plug such ends with brick and mortar.
2. Entirely remove abandoned utility structures unless otherwise specified or indicated on the Drawings.

3. Remove from the excavation materials which can be readily salvaged and store on the Site.
4. Salvageable materials will remain the property of Owner unless otherwise indicated by Owner.

E. Extra Earth Excavation:
1. If soft material, which in the opinion of Engineer or independent testing laboratory is not suitable, is encountered below the normal trench bottom or below a utility structure Engineer may order the removal of this soft material and its replacement with specified material in order to make a suitable foundation for the construction of the utility or utility structure.
2. Extra earth excavation made at the order of Engineer will be paid for on the basis of the actual quantity of material excavated. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
3. No extra payment will be made if removal is required as a result of poor dewatering techniques.
4. Special foundations shall be determined on an individual basis by Engineer in cooperation with Contractor, unless otherwise provided in the Contract Documents.

3.2 EXCAVATION AND TRENCHING

A. General:
1. By open cut from surface unless designated otherwise.
2. Slope sides of trench adequately for protection of the Work and safety of workers.

B. Maximum Length of Open Trench: 200 feet.

C. Width:
1. Minimum Clearance on Each Side of Utility:
   a. To 16 Inches Diameter: 8 inches.
   b. Greater Than 16 Inches Diameter: Pipe outside diameter times 1.25 plus 12 inches.
2. Maximum Width of Trench at Top of Bedding:
   a. Up Through 30-Inch Diameter Utility: 16 inches plus utility diameter.
   b. Greater Than 30-Inch Diameter Utility: 24 inches plus utility diameter.
3. Maximum Width of Trench at Ground Surface:
   a. Not outside of the property line or easement.
   b. As required for protection of the Work and safety of workers.
   c. Use sheeting, bracing and shoring if required.
4. Provide sufficient space in the trench to permit the joint to be properly made.

D. Depth:
1. Excavate to provide the elevations, grades, and depths of cover indicated on the Drawings and herein specified.
2. The 4 inches of required bedding material below the utility may be omitted if:
   a. Approved by Engineer.
   b. Contractor arranges and pays for testing of the native material.
   c. The native material complies with MDOT 902 Granular Material Class II material, modified so that 100% passes a 1/2-inch sieve.
   d. The material is compacted as specified herein.
3. Excavate to the normal trench bottom elevation with an accuracy of ± 0.10 feet.

E. Rock Excavation:
1. Where rock excavation is encountered within the excavation, expose the surface of the rock sufficient to permit adequate measurements to be taken before the rock excavation is started.
2. Notify Engineer prior to removal if rock is encountered.
3. No utility shall be within 6 inches of rock.
4. Blasting:
   a. Only with permission of Engineer and in accordance with laws and regulations applying thereto.
   b. Secure permit if required.
   c. Notify utility and public agencies.
   d. Explosives shall be used with extreme care by experienced workers only.
   e. Hours shall be fixed by Engineer.
   f. Contractor solely responsible for safety, damage and control of blasting operations.

F. Bedding:
1. Place the bedding material up to 1/8 the height of the utility. Compact as herein specified.
2. Accurately shape the bedding material to fit the pipe shape. Recess the bedding to relieve the pressure on the bell or other projecting utility joint.
3. After laying out the utility, tamp additional bedding in place up to the midpoint of the utility. Use hand-operated compactors to achieve the required compaction.
4. Place additional bedding up to 12 inches above the top of the utility. Use hand operated compactors to achieve required compaction.
5. Place bedding in maximum lifts of 10 inches.
6. No payment shall be made for aggregate or stone bedding when used for Contractor convenience.

G. Trench Backfill:
1. Use backfill material as each Drawing detail indicates and as the material is defined herein.
2. Place backfill in 12-inch lifts and compact as herein specified. Engineer will consider greater lifts if testing indicates that the required compaction is being achieved.

H. Utility Structures:
1. Place and compact specified bedding below utility structures.
2. Backfill around utility structures shall be of the same type backfill as that required for the trench in accordance with these Contract Documents.
3. Place backfill in 12-inch lifts and compact as herein specified.

3.3 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. General: Contractor responsibility and expense.

B. Disposal Sites:
1. Material desired by Owner shall be disposed of by Contractor in the following priority order:
   a. At locations designated by the Contract Documents.
   b. At locations on or within 5 miles of the Project Site designated by Owner after construction starts.
   c. At locations on the Project Site by written arrangement with individual property owners.
   d. Owner may choose not to accept certain materials, including but not necessarily limited to, items from clearing, muck, peat, marl and whole or broken man-made items removed by construction.
2. Material not desired by Owner shall be disposed of in a location determined by Contractor.
3. Disposal of materials shall not violate laws, rules, regulations and the like regarding the filling of flood plains, wetlands and other environmentally sensitive areas.
4. Provide adequate controls to maintain disposal sites in a neat and safe condition by periodic leveling of material, and such other practices as are necessary.
5. Provide soil erosion control measures necessary to prevent soil erosion and sedimentation of wetlands, rivers, ditches, or similar low lying areas.

3.4 EXCESS WATER CONTROL

A. Regulations and Permits: Comply with soil erosion control permit in accordance with Mich. P.A. 451, Part 91 of 1994, the Natural Resource and Environmental Protection Act, and all pertinent rules, laws, and regulations.

B. Unfavorable Weather:
1. Do not place, spread or roll fill material during unfavorable weather conditions.
2. Do not resume operations until moisture content and fill density are satisfactory to Engineer or independent testing laboratory.

C. Pumping and Drainage:
1. Provide, maintain and use at all times during construction adequate means and devices to promptly remove and dispose of water from every source entering the excavations or other parts of the Work.
2. Dewater by means which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil. Use wells, portable pumps, temporary underdrains, or other methods as necessary.

3. Perform Pumping and Drainage:
    a. In such a manner to cause no damage to property or structures and without interference to the rights of the public, owners of private property, pedestrians, vehicular traffic, or the work of other contractors.
    b. In accordance with pertinent laws, rules, ordinances, and regulations.
4. Do not overload or obstruct existing drainage facilities.

D. General:
1. Keep excavations dry during construction.
2. Remove water by use of wells, well points, portable pumps, bailing, drains, underdrains or other acceptable methods.
3. Provide crushed stone or gravel as required to aid dewatering operations.
4. Divert or temporarily reroute existing sewers and drainage of discharge lines to adequate and acceptable outlets during construction. Contractor responsible to ascertain availability of outlets.
5. Divert surface water from entering excavations by construction and maintenance of channels or berms.
6. Sediment traps and other soil erosion control measures shall prevent soil particles from entering any sewer, watercourse or similar conveyance.
7. Protect utilities, utility structures, and structures, existing and new, from hydrostatic uplift.

3.5 SHEETING, SHORING AND BRACING EXCAVATIONS

A. General:
1. Furnish, put in place and maintain sheeting, bracing and shoring as may be required to properly support the sides of excavations and to prevent movement of earth which could in any way injure the Work or adjacent property.
2. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the Work and adjacent property.
3. A pipe-laying box may be used in lieu of sheeting.

B. Sheeting:
1. Do not install by jetting.
2. Remove as backfilling proceeds, unless ordered left in place by Engineer. Use care to fill and compact voids created by removal, especially below mid-height of utility.
3. Sheeting Left in Place:
    a. Requires written approval of Engineer.
    b. Cut off minimum of 2 feet below finished grade.

3.6 CLEANUP

A. Upon completion of the work of this Section, remove all excess excavated material, trash, and debris resulting from construction operations. Remove equipment and tools. Leave the Site in a neat and orderly condition acceptable to Engineer, and in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 31 23 03

SECTION 31 23 06 – EXCAVATION AND FILL FOR STRUCTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Excavation.
   2. Backfilling.
   3. Proof rolling.
   4. Sheeting.
   5. Bracing.
   6. Shoring.
   7. Disposal of excavated materials.
   8. Excess water control.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standards:
      a. D698 - Laboratory Compaction Characteristics of Soil Using Standard Effort.
      b. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
   2. MDOT:
      a. 2003 Standard Specifications for Construction.
      b. Standard Plans.

1.4 DEFINITIONS

A. Terms:
   1. Driving Surface: A pavement, curb, or sidewalk.
   2. Excavation:
      a. Removing the following materials from their present location:
         1) Native below-grade material such as soil, rocks, boulders less than 1/2 cubic yard in volume, and buried trees.
         2) Man-made items such as, but not necessarily limited to:
            a) Bituminous and concrete paving.
            b) Curbs.
            c) Riprap.
            d) Head walls.
            e) Underground utilities.
            f) Manholes and catch basins.
            g) Foundations.
            h) Sidewalks.
   3. Fill: Imported material, or where allowed native material, which is placed in structure undercut.
   4. Hardpan:
      a. Cemented soil layers.
      b. Is not hard clay layers that are not cemented.
   5. Imported Material: Soil material which is hauled onto the Site from an off-Site location.
   6. Native Material:
      a. Soil and other natural earth materials, except rock, which are existing on the Site prior to the start of Work.
      b. Also called overexcavation.
   7. Pavement: A combination of subbase, base course, and concrete, bituminous or aggregate surface course, including shoulders, placed on a subgrade. Includes roadways, parking areas, driveways, and bituminous seal coat.

8. Rock Excavation:
   a. Excavation of igneous, metamorphic, or sedimentary rock or hardpan which cannot be excavated without continuous drilling or blasting or continuous use of a ripper or other special equipment.
   b. Excavation of boulders of 1/2 cubic yard or more in volume.
9. Structure: A building, retaining wall, tank, footing, slab, or other similar construction.
10. Structure Backfill: Soil or other material which is placed against walls or sides of structures.
11. Subbase: The layer of material placed on the subgrade as part of the pavement structure.
12. Subgrade:
   a. Below structures and below fill on the Site: The top elevation of the undisturbed native material after topsoil is stripped off and excavation is completed.
   b. Below driving surfaces: The bottom elevation of the subbase.
13. Undercut: Excavation of native material from below the bottom of footings, floors, structures, and subbases.
14. Utility Structures: Manhole, catch basin, valve chamber, junction chamber, water main valve, or other similar utility appurtenance.
15. Other Definitions: Other earthwork terms not defined in the Contract Documents shall be as defined in MDOT Standard Specifications for Construction.

1.5 DESIGN AND PERFORMANCE REQUIREMENTS

A. Excavation Side Stability: Be responsible for the structural design of sheet piling, underpinning, shoring, and bracing to prevent sides of excavation from collapsing and causing damage to adjacent structures, pavements, and materials.

B. Quantities: Determine the required quantities of earthwork materials and operations and use as the basis for the lump sum Bid.

1.6 QUALITY ASSURANCE

A. Perform special inspections in accordance with Division 01 Section “Special Inspections and Tests.”

B. Compaction:
   1. Predominately Granular Soils:
      a. Determine density using the modified Proctor method, ASTM D1557.
      b. Compact fill and backfill to at least 95% maximum density.
      c. The first 12-inches of subgrade below structures, fill and backfill on the Site:
         1) Test for density.
         2) Compact to at least 95% maximum density if the existing density is below 95%.
   2. Predominately Cohesive Soils:
      a. Determine density using the standard Proctor method, ASTM D698.
      b. Compact fill and backfill to at least 95% maximum density.
      c. The first 12-inches of subgrade below all structures, fill, and backfill on the Site:
         1) Test for density.
         2) Compact to at least 95% maximum density if the existing density is below 95%.

1.7 SUBMITTALS

A. Quality Assurance/Control Submittals: For imported materials:
   1. Source.
   2. Classification.
   3. Gradation.

1.8 PROJECT CONDITIONS

A. Dust Control:
   1. Use legal means necessary to control dust on and near the Work and on and near off-Site borrow areas if such dust is caused by Contractor's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.

2. Moisten or otherwise treat haul roads, delivery roads, temporary site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.
3. Scrape, broom, or vacuum adjacent streets to remove tracked dirt every Friday afternoon, or more often as necessary if directed by Engineer.
4. Utilize vacuum if dust from brooming is excessive in opinion of Engineer.

B. Existing Structures, Utility Structures, and Utilities:
1. Call MISS DIG to locate existing underground utilities prior to starting excavation.
2. Where utilities, utility structures, or structures are encountered which are in active use:
   a. Provide adequate protection for them.
   b. Be responsible for damages to them.
3. Provide stand-by utility service if temporary removal is necessary for a period exceeding 2 hours.
4. Where utility service connections to occupied buildings must be temporarily disconnected, give 48 hours' notice to the affected occupants of the time and duration of the anticipated shutoff.
5. Notify Fire Department 48 hours in advance if water main or fire supply line shutoff is required.
6. Raise, lower, or move underground utilities, utility structures, or structures which interfere with the structure being constructed as part of this Work.

C. Special Backfilling Requirements:
1. Comply with the regulations of the MDOT, county road, and railroad company engineering departments with regard to filling, backfilling and compaction in their respective rights-of-way.
2. Obtain necessary permits for filling off Site.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. Material: Subject to the review of special inspector.
2. For review of imported material, notify special inspector at least 1 week in advance of intention to import material, designate the proposed borrow area, and permit special inspector to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material.

B. Material Sources and Uses:
1. Imported Material:
   a. Granular layers below floor slabs.
   b. Fill in structure undercut.
2. Native material unless quantity or quality is not sufficient; then shall be imported material:
   a. Structure fill and backfill below structures and driving surfaces.
   b. Structure backfill not below and driving surfaces.

C. Granular Layer Below Floor Slabs:
1. Choose Either of the Following:
   a. Sand-gravel fill of such gradation that 100% will pass a 1/2-inch sieve and not more than 10% by weight is lost by washing.
   b. MDOT 902, Granular Material Class II modified to 100% passing a 1/2-inch sieve.

D. Fill In Structure Undercut: MDOT 902, Granular Material Class II.

E. Structure Backfill Not Below Driving Surfaces:
1. Native material.
2. Exclusive of gray or blue clay, peat, organic matter, or frozen lumps.
3. Containing no rocks or lumps over 3 inches in greatest dimension.
4. Obtain approval for using native material as backfill from special inspector.

2.2 OTHER MATERIALS

A. Other materials, not specifically described but required for proper completion of the work of this Section, shall be as selected by Contractor subject to the review of special inspector.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavating, Backfilling, and Compacting:
   1. For Structures: In accordance with this Section.
   2. For Utility Structures: In accordance with Division 31 Section “Excavation and Fill for Utilities.”

B. Bracing and Sheeting:
   1. Do not install by jetting.
   2. Furnish, put in place, and maintain sheeting, bracing, and shoring as may be required to properly support the sides of excavations and to prevent movement of earth which could injure the Work or adjacent property.
   3. Exercise care in the removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported and damage to the Work and adjacent property.
   4. Do not leave sheeting or bracing in the excavation after completion of the Work, unless reviewed by Engineer.

C. Obstructions: Remove and dispose of buried trees, rocks, boulders, driving surfaces, pipes, and the like, as required for the performance of the Work.

D. Cutting Paved Surfaces and Similar Improvements:
   1. Cuts: A minimum of 1-foot wider than excavation on each side.
   2. When the remaining width of paved surface is less than 4 feet, remove the entire paved surface.
   3. Before removing pavement, mark the pavement neatly.
   4. Concrete:
      a. Pavements: Saw cut if over 3 feet from expansion or construction joint, otherwise remove to joint.
      b. Sidewalks: Remove to joints.
      c. Curb and Gutter: Remove to joints.
   5. Final Surface Course Bituminous: Saw cut joints unless otherwise reviewed by Engineer.
   6. Do not disturb or damage the adjacent pavement.
   7. If the adjacent pavement is disturbed or damaged, remove the damaged pavement and place new pavement of a type that matches the existing.
   8. Tunneling under curbs that are encountered is permitted, however, place new curb where existing curb is disturbed by construction.
   9. Dispose of materials removed.

E. Undercut:
   1. If suitable bearing for foundations is not encountered at the elevations indicated on the Drawings immediately notify Engineer.
   2. If soft material, which in the opinion of special inspector is not suitable, is encountered below a structure, Engineer may order the removal of this soft material and its replacement with specified material in order to make a suitable foundation for the construction of the structure.
   3. Undercutting made at the order of Engineer will be paid for on the basis of the actual quantity of material excavated.
   4. Do not proceed further until instructions are received and necessary measurements made for purposes of establishing additional volume of excavation.
   5. No extra payment will be made if removal is required as a result of poor dewatering techniques.
   6. Include undercutting which is specifically indicated on the Drawings or herein specified in the base Bid.
   7. Soil removed may be used as fill or backfill in areas not below driving surfaces, structures, or utility structures.
   8. Compact subgrade at bottom of undercut prior to placing fill.
   9. Place and compact specified fill in undercut.
   10. Lateral Extent of Undercut: A horizontal distance equal to the depth of undercut below structure.

F. Proof-Rolling:
   1. Proof-roll exposed subgrade of structure footprint in the presence of the special inspector.
      a. Provide loaded heavy rubber-tired dump truck, or similar, and labor for proof-rolling.
   2. In subgrade areas identified by the special inspector, provide compaction or replace unsuitable subgrade areas with specified fill.

G. Excavating:
1. Perform excavation by open cut from the surface except as herein specified or as indicated on the Drawings.
2. Perform excavations for structures in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for the removal of materials excavated.
3. Excavate to the required cross section and elevation indicated in the Drawings.
4. Subgrade Elevation: Within 0.1 feet above or below the established elevations.
5. Fill depressions caused by excess excavation, traffic or rolling with specified fill, rerolled and compacted in place as specified herein.

H. Thermal Protection: Protect bottoms of excavations from frost and freezing.

3.2 COMPACTION

A. Select compaction equipment to achieve the required compaction without damaging adjacent structures.
1. Suggested Equipment Selections:
a. If soil is predominantly granular, use pneumatic tired or vibratory drum rollers loaded to not less than 325 pounds per rated inch of tire width.
b. For Clay Soils:
1) Compact each layer with sheepsfoot rollers.
2) Utilize rollers with staggered rows of feet projecting not less than 7 inches from drum and loaded to produce at least 200 pounds per square inch of tamping area in contact with the ground.
c. Compact around structures with hand-operated vibrating compactors for granular soils and Barco rammer type compactors for clay soils.

B. Moisture:
1. Compact fill and backfill with moisture content of 2.0% below to 2.0% above optimum soil moisture content.
2. If material is too wet, provide and operate reviewed means to assist the drying until suitable for compaction.
a. If material is too dry, provide and operate reviewed means to add moisture to the layers.

3.3 FILL

A. General:
1. Do not place fill until the subgrade been examined by special inspector .
2. Place fill in even layers not exceeding 10 inches in depth and thoroughly compact as herein specified.
3. Do not place additional fill until compaction on a lift complies with specification requirements.
4. If an analysis of the soil being placed shows a marked difference from 1 location to another, do not use a mixture of those materials for the fill being placed.
5. Handle each different type of material continuously and consistently so that field control of moisture and density may be based upon a known type of material.
6. Do not place fill following a heavy rain without first making certain on isolated test areas that compaction can be obtained without damage to the already compacted fill.

3.4 STRUCTURE BACKFILL

A. General:
1. Remove debris from excavations before backfilling.
2. Do not backfill against foundation walls until:
a. Reviewed by Engineer.
b. Indicated perimeter insulation is in place.
3. Protect insulation and waterproofing, if any, during filling operations.
4. Wherever possible, backfill simultaneously on both sides of walls to equalize lateral pressures.
5. Do not backfill on only 1 side of vertically spanning walls unless walls are adequately shored, or permanent construction is in place to furnish lateral support on both top and bottom of wall.
6. Place backfill in layers not exceeding 10 inches in depth.
7. Do not place backfill on frozen subgrade.

3.5 EXCESS WATER CONTROL

A. Provide dewatering to permit construction as indicated on the Drawings and specified herein.

B. Regulations and Permits: Comply with soil erosion control permit in accordance with pertinent rules, laws, and regulations of the authority having jurisdiction.

C. Unfavorable Weather:
   1. Do not place, spread, or roll material during unfavorable weather conditions.
   2. Do not resume operations until moisture content and density are satisfactory to special inspector.

D. Pumping and Drainage:
   1. Provide, maintain, and use adequate means and devices throughout the construction to promptly remove and dispose of water from every source entering the excavations or other parts of the Work.
   2. Dewater by means which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil.
   3. Use wells, portable pumps, temporary underdrains, or other methods as is necessary.
   4. Perform pumping and drainage:
      a. In such a manner to cause no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, and the work of other contractors.
      b. In accordance with pertinent laws, rules, ordinances, and regulations.
   5. Do not overload or obstruct existing drainage facilities.
   6. Provide berms or channels to prevent flooding of subgrade.
   7. Promptly remove water collected in depressions.
   8. Ensure water is removed prior to placing concrete; do not place concrete into standing water.

3.6 DISPOSAL OF EXCESS EXCAVATED MATERIAL

A. General:
   1. Remove and properly dispose of excavated material not needed to complete filling and backfilling.
   2. Dispose of excess excavated material at a location on the Site as directed by Owner.
   3. When disposing materials, do not violate laws, rules, regulations, and the like regarding the filling of flood plains, wetlands, and other environmentally sensitive areas.
   4. Provide adequate controls to maintain disposal sites in a neat and safe condition by periodic leveling of material and such other practices as are necessary.
   5. Provide soil erosion control measures necessary to prevent soil erosion and sedimentation of wetlands, rivers, ditches, or similar low-lying areas.

3.7 CLEANING

A. Upon completion of the work of this Section, remove excess excavated material, trash, and debris resulting from construction operations.
   1. Remove equipment and tools.
   2. Leave the Site in a neat and orderly condition acceptable to Engineer, and in conformance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 31 23 06

SECTION 31 23 24 – FLOWABLE FILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of flowable fill.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standards, Specifications, Methods, Test Methods and Classifications:
      a. C33 - Specification for Concrete Aggregates.
      b. C39 - Test Method for Compressive Strength of Cylindrical Concrete Specimens.
      c. C94 - Specification for Ready-Mixed Concrete.
      d. C136 - Sieve Analysis of Fine and Coarse Aggregates.
      e. C150 - Specification for Portland Cement.
      f. C260 - Specification for Air-Entraining Admixtures for Concrete.
      g. C618 - Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
   2. ACI - American Concrete Institute:
      a. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
      b. 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
      c. 304.2R - Placing Concrete by Pumping Methods.
      d. 305R - Hot Weather Concreting.
      e. 306R - Cold Weather Concreting.
   3. MDOT:
      a. 2003 Standard Specifications for Construction.
      b. Standard Plans.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Formwork: The design and construction of all formwork shall be the responsibility of Contractor.

B. Mix Proportions: Select flowable fill proportions according to the procedures specified herein to achieve the specified performance requirements.

1.5 SUBMITTALS

A. Design Data:
   1. Submit flowable fill mix design.
   2. Allow for 28-day testing of trial mixes in the Project's schedule, if trial mixes are required.
   3. Required Information:
      a. Dry weights of cement.
      b. Saturated surface-dried weights of fine aggregate.
      c. Quantities, type and name of all mix design contents.
      d. Weight of water.

B. Test Reports:
   1. Submit reports of trial mix and field compression, air content and slump tests.
   2. Furnish copies to Engineer and Contractor.

1.6 QUALITY ASSURANCE

A. Installation Personnel Qualifications:
   1. Trained and experienced in the installation of the materials.
   2. Knowledgeable of the design and the reviewed mix designs.

B. Flowable Fill Supplier Qualifications:
   1. Ready-mix concrete producer.
   2. Experienced in design and control of flowable fill.

C. Testing of Flowable Fill: In accordance with concrete testing provisions of Division 01 Section “Testing Services for Buried Utilities, Roadways, and Site Projects,” except as follows:
   1. Air entrainment, unit weight and slump only need to be determined for each set of cylinder samples, not more often.
   2. Cylinders shall be air cured at room temperature in the cylinder molds.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:
   1. Portland cement, ASTM C150, Type I.
   2. Do not use different types or manufacturers of cement interchangeably without Engineer's approval.

B. Fly Ash: ASTM C618, Type C or F.

C. Aggregates:
   1. Grade aggregates according to procedures of ASTM C136.
   2. Aggregates shall be inert, non-chemically reactive, and non-radioactive.
   3. Fine aggregate: ASTM C33 or MDOT 902 Fine Aggregate 2NS.

D. Water: Clean, fresh, and potable.

E. Admixtures:
   1. Chlorides:
      a. No admixture shall contain more than 0.1% water soluble chloride ions by mass of cementitious material.
      b. No admixture shall contain calcium chloride.
   2. Air-Entraining: Daravair series or Darex series, by W.R. Grace & Company; Micro Air, by Master Builders; or equal.
   3. Stable Air Generator: Darafill, by W.R. Grace & Company; Flow-Air, by Axim Concrete Technologies; or equal.

2.2 MIXES

A. Methods of Proportioning Mixes:
   1. Past performance: Only if required test data is available and submitted.
   2. Trial mixes: If required test data is not available.

B. Proportioning by Past Performance:
   1. Select proportions of materials for flowable fill in accordance with ACI 211.1, in order to produce flowable fill that:
      a. Is within the specified compressive strength range.
      b. Has good placability and low segregation.
      c. Is self-leveling, self-compacting and self-curing.
   2. The target compressive strength of the flowable fill shall be an average of the maximum and minimum values of specified compressive strength.

3. Documentation:
   a. Where the flowable fill production facility has 10 or more field strength tests for flowable fill produced with similar materials and under similar conditions, these tests may be used to demonstrate that the proposed proportions will produce flowable fill within the specified compressive strength range.
   b. Where the flowable fill production facility does not have test records specified herein, flowable fill proportions shall be established based on trial mixtures in accordance with Article 2.2 C.
4. Provide mix design, test records and other documentation to Engineer at least 14 days prior to placement.
5. Should trial mixes be required, place no flowable fill until results from the 28-day tests have been reviewed and approved by Engineer.

C. Proportioning by Trial Mixes:
1. Select proportions of materials for flowable fill in accordance with ACI 211.1, in order to produce flowable fill that:
   a. Is within the specified compressive strength range.
   b. Has good placability and low segregation.
   c. Is self-leveling, self-compacting and self-curing.
2. Prepare trial mixes of 1 cubic yard each minimum and deliver to the Project Site for each mix design. Upon Contractor request, Engineer may waive trial mix testing for some mix designs.
3. Make trial mixes using at least 3 different water-cementitious ratios or cementitious contents that will produce a range of compressive strengths encompassing an average of the maximum and minimum values of the specified compressive strength range.
4. Design Trial Mixes to Produce:
   a. A slump within ± 0.75-inch of maximum permitted.
   b. For air-entrained flowable fill, an air content within ± 1.0% of maximum allowable.
   c. For flowable fill with a stable air generator, an air content within the specified range.
5. Make 6 cylinders from each trial mix and cured in accordance with ASTM C31 or C192, as applicable. The testing laboratory will test the cylinders in accordance with ASTM C39 at the times listed as follows:
   a. 1 at 3 days.
   b. 1 at 7 days.
   c. 1 at 14 days.
   d. 2 at 28 days.
   e. 1 spare.
6. From results of cylinder tests plot a curve showing relationship between water cementitious ratio or cementitious content and compressive strength at the 28 day test age.
7. Use the water-cementitious ratio or cementitious content for flowable fill shown by the curve to produce an average of the maximum and minimum values of the specified compressive strength range.
8. Provide mix design, test records and other documentation to Engineer at least 7 days prior to placement.
9. Place no flowable fill until results from the 28-day tests have been reviewed by Engineer.

D. Mix Design Performance Requirements:
1. Mix 1:
   a. Flowable fill which may be hand excavated in the future.
   b. Compressive Strength Range f'c: 40 to 75 psi at 28 days.
   c. Slump: 6 to 8 inches, minimum.
   d. Air Content: 15% to 35% utilizing stable air generator.

2.3 SOURCE QUALITY CONTROL

A. Production and Delivery:
1. Batch, mix and transport flowable fill in accordance with ASTM C94.
2. Furnish a delivery ticket with each batch of flowable fill before unloading at the Site, on which is printed, stamped or written the following information:
   a. Name of ready-mix batch plant.
   b. Serial number of ticket.
   c. Date and truck number.
   d. Name of Contractor.
   e. Job name and location.
   f. Specific class or designation of flowable fill.

g. Amount of flowable fill (cubic yards).
h. Time loaded or of first mixing of cement and aggregates.
i. Type, name and amount of admixture.
j. Type, brand and amount of cement and fly ash.
k. Total water content by producer (or water-cementitious ratio).
l. Maximum size of aggregate.
m. Weight of fine aggregate.

3. Flowable fill delivered in an outdoor temperature lower than 40 degrees F shall arrive at the Site of the Work having a temperature of not less than 50 degrees F and not greater than 90 degrees F unless otherwise specified or permitted by Engineer's representative.
4. Complete the discharge of the flowable fill within 2-1/2 hours after introduction of mixing water to the cement or 2 hours after arriving at the Site, whichever is sooner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Preplacement Inspection:
1. Before placing flowable fill, inspect and complete the formwork installation.
2. Notify other trades to permit the installation of their work; cooperate with other trades in setting such work, as required.

B. Components:
1. Seal pipes, manholes and similar components not intended to be filled.
2. Restrain from floatation.

3.2 PLACEMENT

A. General:
1. Ensure flowable fill fills all cavities required to be filled.
2. Avoid dislocation of components.
3. Place in lifts if required to prevent floatation or to limit fluid pressures on formwork, walls, flexible wall pipe, or similar conditions.
4. Wait 24 hours, minimum, between the start of subsequent placement lifts.

B. Handling:
1. Handle flowable fill from mixer to place of final deposit in chutes, carts, buggies, conveyors, pumps or crane buckets.
2. Do not deliver flowable fill by a method with a free fall of more than 3 feet.
3. Take every possible precaution to prevent separation or loss of ingredients while transporting flowable fill.

C. Rate: Carry on placement at such a rate that flowable fill surfaces not yet to grade or lift shall not have reached their initial set before additional flowable fill is placed.

D. Retempering: Do not add water to the flowable fill once it has left the ready-mix plant.

E. Cold-Weather Operations:
1. Comply with the recommendations of ACI 306R.
2. Recommended Protective Measures:
a. Heating materials.
b. Providing insulating blankets and windbreaks.
c. Use heated enclosures.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place on frozen subgrade.

F. Hot-Weather Operations:
   1. Comply with the recommendations of ACI 305R.
   2. Recommended Protective Measures:
      a. Cooling materials.
      b. Placement during cooler hours of the day.
      c. Providing shading and windbreaks.

3.3 PROTECTION

A. Cold Weather:
   1. Keep all freshly placed flowable fill from damage due to low temperatures when the mean daily temperature is below 40 degrees F (4.5 degrees C) in accordance with ACI 306R.
   2. Protect flowable fill from freezing until hardened, 36 hours minimum.

B. Loading: Protect flowable fill from construction, traffic or other loads until sufficient strength has been reached.

END OF SECTION 31 23 24

SECTION 31 25 00 – EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing, installation and maintenance of soil erosion and sedimentation control (SESC) measures.
   1. Minimum SESC measures/Best Management Practices (BMP) are indicated on the Drawings. These measures are to be installed correctly before any grading or excavating begins on the Site. Contractor should add additional BMP's as required by their operations, such as temporary stock piles, equipment storage etc.
   2. Stage Construction and stabilization activities to minimize the amount of disturbed area at any one time.
   3. Remove sediment caused by erosion from storm water before it leaves the Site or enters waters of the state.
   4. Place soil piles away from drainage courses. Soil piles must be protected from precipitation and wind with non-erosive covers or other BMP's.
   5. Provide anti-tracking areas for haul roads and equipment. Sweep streets, parking areas regularly as needed.
   6. Dust control must be implemented on all sites exposed to wind erosion.
   7. Keep copies of permits and inspections on Site at all times.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. Soil erosion and sedimentation control rules and guidelines of:
      a. State of Michigan R323.2190 National Permit for stormwater discharge from Construction (Michigan's "Permit by Rule").
      b. Michigan Natural Resources and Environmental Protection Act, Part 31 of Act 451 of 1994 Soil Erosion and Sedimentation Control (Water Resources Protection Act).
      c. Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (Soil Erosion and Sedimentation Control (SESC).
      d. EGLE Nonpoint Source Best Management Practices Manual.
      e. Michigan Department of Transportation SESC Design Manual.
   2. ASTM Standards:
      a. A974 – Standard Specification for Welded Wire Fabric Gabions and Gabion Mattresses (Metallic-Coated or Polyvinyl Chloride (PVC) Coated).
      b. C33/C33M – Standard Specification for Concrete Aggregates.
      c. D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
      d. D4751 -Standard Test Method for Determining Apparent Opening Size of a Geotextile.
      e. D4992 – Standard Practice for Evaluation of Rock to be Used for Erosion Control.
      f. D5313 – Standard Test Method for the Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions.
      g. D6092 – Standard Practice for Specifying Standard Sizes of Stone For Erosion Control.
      h. D6459 – Standard Test Method for Determination of Erosion Control Blanket (ECB) Performance in Protecting Hillslopes from Rainfall-Induced Erosion.
      i. D6461, D6462 – Standard Practice for Silt Fence Materials and Installation.
      j. D6599 – Practice for Construction of Live Fascines on Slopes.
      k. D6711 – Practice for Specifying Rock to Fill gabions, Revet Mattresses, and gabion Mattresses.

1.4 SUBMITTAL

A. Action Submittals (Manufacturers information):
   1. Mulch blankets.
   2. Geotextile fabric.
   3. Silt Fence.
   4. Inlet Protection.
   5. Seed mixtures.
   6. Tacking Agents.
   7. Fertilizer.
   8. Turbidity curtain.

B. Informational Submittals:
   1. Name and certification number of certified storm water operator that will be responsible for Site inspections.
   2. Sequence of Construction in sufficient detail as requested by Engineer.

1.5 QUALITY ASSURANCE

A. Performance Standard:
   1. Compliance with the Soil Erosion Control Permit (Part 91) and the Michigan Permit by Rule. The SESC measures indicated on the Drawings and specified here in are a minimum requirement. If more SESC measures are required to comply with the permit, notify the Engineer responsible for preparation of the SESC plan for plan amendment. Additional SESC measures required due to the Contractor's operations will not be considered for additional payment.

B. SESC Preconstruction Meeting:
   1. Conduct a field evaluation of the Site with the Engineer, Certified Storm Water Operator, the Local Enforcing Agent, and the Contractor's Superintendent after all initial SESC measures are installed and prior to any clearing, grading or excavation work.
   2. This meeting shall be scheduled and organized by the Contractor.
   3. Review the installed SESC measures by walking the Site and confirm compliance to the Permit and the approved SESC Plan.
   4. Review the location for display of the permit.
   5. Review location for SESC inspection log.

C. Stop Work Order:
   1. Owner reserves the right to issue a Stop Work Order if soil erosion and sedimentation controls are not properly installed or maintained.
   2. Work performed under a Stop Work Order will not be considered for payment.
   3. Costs resulting from delay due to issuance of a Stop Work Order shall be the responsibility of Contractor.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, damage by weather or elements, and in accordance with manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 SOIL EROSION AND SEDIMENTATION CONTROL MATERIALS

A. Stabilized Construction Entrance:
   1. Stabilize a pad of clean crushed stone located at points where traffic will be accessing a construction site. Minimize construction access points to locations as indicated on the Drawings.

2. Stone Size – Use ASTM C33, size No. 2 (2-1/2-inch to 1-1/2-inch) or 3 (2 inch to 1 inch). Use clean crushed angular stone. Crushed concrete of similar size may be substituted, but will require more frequent upgrading and maintenance.
3. Place on woven geotextile fabric if underlying soils are soft. TerraTex GS, or equal.
4. Thickness: Not less than 6 inches.
5. Width: Not less than full width of points of ingress or egress or a minimum of 20 feet.
6. Length: 50 feet minimum where the soils are course grained (sands or gravels) or 100 feet minimum where soils are fine grained (clays or silts), except where the traveled length is less than 50-feet or 100 feet respectively. These lengths may be increased where field conditions dictate. Stormwater from up-slope areas shall be diverted away from the stabilized pad where the slope of the access road exceeds 5%, a stabilized base of Hot Mix Asphalt Base Course.

B. Temporary Vegetation:

Seed Type	Lower Peninsula (south of US10)*	Lower Peninsula (north of US10)*	Upper Peninsula*	Seeding Rate
Oats, Barley	4/1 to 9/15	4/15 to 8/1	5/1 to 8/1	2 lbs/1,000 sft
Annual Rye	8/1 to 10/15	8/1 to 10/10	8/1 to 11/1	3 lbs/1,000 sft
Wheat	9/20 to 10/15	9/10 to 10/10	9/10 to 10/1	3 lbs/1,000 sft
Buckwheat	6/1 to 7/15	6/1 to 7/15	6/15 to 7/15	2 lbs/1,000 sft
Perennial Ryegrass	8/1 to 10/15	8/1 to 10/1	8/1 to 10/1	1 lbs/1,000 sft
*Seasonal Limitation Dates				

C. Permanent Vegetative Cover:
1. Grade as needed and feasible to permit the use of conventional equipment for seedbed preparation, seeding, mulch application, and mulch anchoring.
2. Immediately prior to seeding and topsoil application, the subsoil shall be evaluated for compaction.
3. Topsoil should be handled only when it is dry enough to work without damaging the soil structure. A uniform application to a depth of 4 inches (unsettled) is required on all sites. Topsoil shall be amended with organic matter, as needed, in accordance with the Standard for Topsoiling.
4. See Division 32 Section “Turf and Grasses” for Seasonal requirements.

D. Mulch Blanket:
1. 4H:1V: Straw; North American Green S-75; LANDLOK S1; or equal
2. 3H:1V: Straw; North American Green S-150; LANDLOK S2; or equal.
3. 2H;1V: Straw and Coconut: North American Green SC-150; North American Green P-300, LANDLOK SC2; or equal.
4. 1.5H:1V: Coconut: North American Green C-125; LANDLOK C2; or equal.
5. Anchoring Staples or Pins:
6. Hardwood stakes at least 6 inches long; or
7. North American Green Bio-Stake blanket pins at least 6 inches long;
8. Steel anchoring pins are not allowed without written permission of the Engineer.

E. Hydro-Mulch:
1. Biodegradable, Hydraulic Mulch (HM) composed of 100% recycled cellulose fibers and a tackifier.
2. Terra-Mulch Cellulose with Tacking Agent 3.

F. Tacking Agents:
1. Materials: Polyacrylamide, acrylamide copolymer, hydro-colloid polymers, marker dye.
2. pH Range: 7.0 ±0.2.
3. Surface Tension: 73.9 dynes/cm, based on simulated field application after 5 minutes of mechanical agitation.
4. Viscosity: 102 CPS ±2, Saybolt value, based on 30 pounds per 1,000 gallons of water and 197 CPS ±2, Saybolt value, based on 60 pounds per 1,000 gallons of water, based on simulated field application after 5 minutes of mechanical agitation.
5. University tested to reduce erosion 68.6% and reduce water runoff 21.7% on a 45% slope without having to cure (dry out), effective immediately after hydro-seeding application.
6. Terra-Mulch Tacking Agent 3 by Profile Products LLC.

G. Riprap:
   1. Stone for riprap shall consist of natural field stone or crushed quarry stone of approximately rectangular shape. The stone shall be hard and angular and of such quality that it will not disintegrate on exposure to water or weathering. The specific gravity of the individual stones shall be at least 2.5.
   2. Recycled rubble concrete may not be used.
   3. The riprap shall be composed of a well-graded mixture such that 50% of the mixture by weight shall be larger than the d50 size as determined from the design procedure. A well-graded mixture as used herein is defined as a mixture composed primarily of the larger stone sizes, but with a sufficient mixture of other sizes to fill the progressively-smaller voids between the stones. The diameter of the largest stone size in such a mixture shall be 1.5 times the d50 size. The d75 should be 1.25 times the d50 and the d15 should be 0.5 times the d50 size.

H. Geotextile Fabric for Riprap:
   1. Synthetic Industries, Terra Tex HD, or equal.
   2. Woven, high strength polypropylene.
   3. Grab Tensile Strength: 315 pounds (min) in accordance with ASTM D4632 (min).
   4. Apparent Opening Size: 40 US sieve (max) in accordance with ASTM D4751 (max).
   5. Water Flow Rate: 4 gpm/sft (min) in accordance with ASTM D4491 (min).

I. Silt Guard:
   1. Above Ground Filters:
      a. Frame and Filter Assembly: Silt Saver, Inc.; or equal.
      b. Nonwoven polypropylene filter with needle punched holes.
      c. High density polyethylene frame.
      d. 60-inch frame, high flow filter.
      e. Filter Material: 120 gpm/sft (min).
      f. Apparent Opening Size (AOS): 40 US Std. Sieve.
      g. Tensile Strength (ASTM D4632): 410/300 (min).
   2. Inlet Protection (Catch Basins):
      a. Siltsak; by ACF Environmental, Inlet Pro Sediment Bag High Flow; by Hanes Geo Components; DANDY BAG by Dandy Products Inc, or equal.
      b. Geotextile fabric silt sump.
      c. Grab tensile strength: 281x170 pounds in accordance with ASTM D4632 (min).
      d. 38 gallons per minute per square foot (GPM/SF), water flow rate in accordance with ASTM D4491 (min).
      e. Apparent Opening Size (AOS): 40 US Sieve.
      f. Manufactured to meet size of inlet.

J. Dewatering Filter Bags:
   1. Ultratech International, Inc.: Ultra Dewatering Bag, SedCatch dewatering Bag; or equal.
   2. Manufactured with pump pipe connection sized to match pump hose.
   3. Nonwoven Geotextile, Needle Punched Polypropylene, 8 oz/syd (min).
   4. Grab Tensile: 205 pounds in accordance with ASTM D4632 (min).
   5. Flow Rate: 90 gpm/sft in accordance with ASTM D4491 (min).
   6. Apparent Opening Size (AOS): 80 US Sieve.

K. Geotextile Silt Fence:
   1. Synthetic Industries, Terra Tex SF-90, or equal.
   2. Woven, high strength polypropylene.
   3. Grab Tensile Strength: 100/100 lbs (min) in accordance with ASTM D4632 (min).
   4. Apparent Opening Size (AOS): 20-50 US sieve (max) in accordance with ASTM D4751 (max).
   5. Water Flow Rate: 8 gpm/sft (min) in accordance with ASTM D4491 (min).
   6. Wood Stakes, Hardwood: 1.5-inch x 1.5-inch x 48-inch (min), 6 foot spacing (max) with 3/8-inch thick lath fastening bar.

L. Check Dams:
   1. Washed Crushed Stone.
   2. Size: 2-inch minimum, 4-inch maximum.

M. Sediment Logs:
1. Curlex Sediment Logs by American Excelsior Co, SEDIMAX-SW; or equal.
2. 12-inch sediment log diameter, 10 or 25 foot length.
3. 40 GPM/sft in accordance with ASTM D5141.
4. Inner Core: Compressed agricultural straw.

PART 3 - EXECUTION

3.1 GENERAL

A. Standards:
1. Achieve Effective Erosion Control to prevent erosion of Site slopes and ditches.
2. Achieve effective control of sedimentation to prevent any offsite discharge or tracking of Site soils.
3. Maintain soil erosion and sedimentation controls until the Site is stable. Definition of stable site is final concrete and/or asphalt paving is complete, and all turf areas have 80% growth.
4. Do not remove temporary soil erosion and sedimentation control measures until Site is determined to be stable by the Engineer.
5. Sweep streets weekly, or more frequently if required, or directed by Engineer.

3.2 DUST CONTROL

A. Prevent blowing and movement of dust from exposed soil surfaces, prevent on Site and off Site damage and health hazards and improve traffic safety:
1. The following methods should be considered for controlling dust.
a. Mulches.
b. Temporary Vegetative Cover.
c. Spray-on Adhesives: Keep traffic off these areas.

3.3 CONSTRUCTION ENTRANCE DRIVE

A. Employ water truck and street sweeper as necessary to keep sediment off of on Site and off Site roadways. The entrance must be maintained in a condition which will prevent tracking or flowing of sediment onto roadways. This may require periodic top dressing with additional stone or additional length as conditions demand and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed, or tracked onto roadways (public or private) or other impervious surfaces must be removed immediately.

B. Where accumulation of sediment is inadequately cleaned or removed by conventional methods, a power broom or street sweeper will be required to clean paved or impervious surfaces. All other access points which are not stabilized must be blocked off.

3.4 INLET PROTECTION

A. Install on existing inlets prior to any grading or excavation. Install on new inlets as soon after installation as practical.

B. Inspect frequently, especially after any rain event. Maintain repair, and replace promptly, as needed.

C. Remove barrier only when the area draining toward the inlet has been stabilized.

3.5 SOIL ROUGHENING

A. On all slopes 1:3 or steeper, grade the slope with a dozer taking a vertical path so that the track marks on the slope create a horizontal roughened grooved condition to help prevent erosion of the slope.

3.6 TEMPORARY VEGETATIVE COVER

A. General:
1. Provide temporary seed if permanent measures will not be placed within 15 days of initial disturbance and area will not undergo further earth change within 15 days of initial disturbance.

2. Seed: Apply uniformly at a minimum rate of 3 to 5 pounds per 1,000 square feet.
3. Mulch:
    a. Mulching is required on all seeding. Mulch will protect against erosion before grass is established and will promote faster and earlier establishment. The existence of vegetation sufficient to control soil erosion must be deemed compliance with this mulching requirement.
    b. Straw: Unrotted small grain straw, free of seeds
    c. Application: Spread mulch uniformly by hand or mechanically so that at least 85% of the soil surface is covered. For uniform distribution of hand-spread mulch 75 to 100 pounds per 1,000 square feet. Anchoring must be accomplished immediately after placement to minimize loss by wind or water. This may be done by one of the following methods, depending upon the size of the area, steepness of slopes.
        1) Peg and Twine. Drive 8 to 10 inch wooden pegs to within 2 to 3 inches of the soil surface every 4 feet in all directions. Stakes may be driven before or after applying mulch. Secure mulch to soil surface by stretching twine between pegs in a crisscross and a square pattern. Secure twine around each peg with two or more round turns.
        2) Mulch Nettings: Staple paper, jute, cotton, or plastic nettings to the soil surface. Use a degradable netting in areas to be mowed.
        3) Crimper (mulch anchoring coulter tool): A tractor-drawn implement, somewhat like a disc harrow, especially designed to push or cut some of the broadcast long fiber mulch 3 to 4 inches into the soil so as to anchor it and leave part standing upright. Straw mulch rate must be 3 tons per acre. No tackifying or adhesive agent is required.
        4) Liquid Mulch-Binders (May be used to anchor straw mulch):
            a) Applications should be heavier at edges where wind may catch the mulch, in valleys, and at crests of banks. The remainder of the area should be uniform in appearance.
            b) Wood-fiber or paper-fiber mulch: must be made from wood, plant fibers or paper containing no growth or germination inhibiting materials, used at the rate of 1,500 pounds per acre (or as recommended by the product manufacturer) and may be applied by a hydroseeder. Mulch must not be mixed in the tank with seed. Use on flatter slopes and during optimum seeding periods in spring and fall.

3.7 PERMANENT VEGETATIVE COVER

A. General:
1. Seed all disturbed areas within 5 days of final grading.
2. Apply uniformly at a minimum rate of 3 to 5 pounds per 1,000 square feet.
3. Mulch as indicated on the Drawings or as needed to effectively control soil erosion.

3.8 MULCH BLANKET

A. Direction of installation, staple patterns and other requirements in accordance with Manufacturer's directions, and Project Drawing detail sheets.

B. Location: Where indicated on the Drawings or as specified.

3.9 HYDRO MULCH

A. Apply in accordance with manufacturer, Application Rate: 2,000 pounds per acre.

3.10 TACKING AGENTS

A. Fiber Mulch Binding:
1. Flat to 5:1 Slope: 20 pounds per acre.
    a. 4:1 to 3:1 Slope: 30 pounds per acre.
    b. 3:1 to 2:1 Slope: 40 pounds per acre.
    c. Greater than 2:1 Slope: 60 pounds per acre.
2. Straw Mulch Binding: 30 pounds Tacking Agent III and 150 pounds cellulose fiber per 1,000 gallons of water per acre, or 50 pounds Tacking Agent III per 1,000 gallons of water per acre.

3.11 GEOTEXTILE SILT FENCE

A. Space posts 6 feet center-to-center or closer. Extend at least -12-inches into the ground. Posts shall be constructed of hardwood with a minimum diameter thickness of 1-1/2 inches.

B. Wire Backed silt fence: A metal fence with 6 inch or smaller wire mesh openings and at least 2 feet high may be utilized, fastened to the fence posts, to provide reinforcement and support to the geotextile fabric. Place posts 6 feet on center.

C. Bury geotextile fabric at least 6 inches deep in the ground. Extend The fabric at least 2 feet above the ground. The fabric must be securely fastened to the posts using a system consisting of metal fasteners (nails or staples) and a high strength reinforcement material (nylon webbing, grommets, washers, etc.) placed between the fastener and the geotextile fabric. The fastening system must resist tearing away from the post. Install silt fence in accordance with manufacturer's instructions, and Project Drawing detail sheets.

D. Location: Where indicated on the Drawings or as needed to prevent offsite movement of soil.

3.12 FIBER ROLLS

A. Vertical spacing on slopes:
   1. As indicated on the Drawings, or
   2. 1:1 slopes: 10 feet apart.
   3. 2:1 slopes: 20 feet apart.
   4. 3:1 slopes: 30 feet apart.
   5. 4:1: slopes: 40 feet apart.

3.13 RIPRAP

A. Place no bends or curves at the intersection of the conduit and apron or scour hole will be permitted.

B. There must be no over fall from the end of the apron to the receiving channel.

3.14 DEWATERING

A. If during construction excavated facilities need to be dewatered to facilitate or complete the construction process and the water pumped out of the excavated areas contain sediments, these sediments must be removed prior to discharging to receiving bodies of water. This standard does not address the removal of ground water through well points etc.

B. Pumping system must include adequate sized perforated riser pipes, stone filters and sediment pumping bags to achieve desired results. Place the suction hose from the pump inside the inner pipe to begin dewatering. Place the discharge hose in a stabilized area downslope of unstabilized areas to prevent erosion.

C. Sediment Tank / Silt Control Bags may be used when sediment laden water is pumped to trap and retain the sediment. A sediment tank or a silt control bag is to be used when excavations are deep, and space is limited and where direct discharge of sediment laden water to stream and storm drainage systems is to be avoided.
   1. Locate containers (tanks or bags) for ease of clean-out and disposal of the trapped sediment and to minimize interference with construction activities and pedestrian traffic. Do not place bags directly into receiving waters.
   2. Tank size: The following formula should be used in determining the storage volume of the tank: 1 cubic foot of storage for each gallon per minute of pump discharge capacity. Typical tank configuration is indicated on Standard Detail. Tanks may be connected in series to increase effectiveness.

3.15 TURBIDITY CURTAIN

A. Install turbidity curtain in accordance with manufacturer's instructions.

B. Location: As required by the Contractor's operations to prevent sediment from migrating more than 30 feet from the point of excavation.

3.16 SEDIMENT BASIN

A. Size and location as indicated on the Drawings. Sediment basins, not indicated on the Drawings but required due to Contractor's means, methods or convenience, will be considered incidental work.

B. Maintenance:
1. Remove sediment when sump basin is 50% full.
2. Remove sediment prior to final completion.
3. Remove outlet barrier when soil disturbed by the work has stabilized.

3.17 VEGETATED SPILLWAY SIDE INLET

A. General: Conform to slopes and dimensions indicated on the Drawings.

B. Grading:
1. Excavate to finished grade of required section and slope.
2. Dig trenches on upstream and downstream toe.
3. Hand rake grade to prepare seed bed.
4. Remove rocks, clods, and clumps larger than 1/2-inch diameter.

C. Fertilizer: Spread fertilizer at a rate of 2 pounds per 100 square foot and rake into seed bed.

D. Geotextile Fabric:
1. Place geotextile fabric in bottom of prepared side inlet.
2. Extend geotextile fabric into trenches for anchorage at upstream and downstream.
3. Staple geotextile fabric at 1-foot to 2-foot intervals.

E. Seeding: Spread seed at a rate of 2 pounds per 100 square feet.

F. Placing Mulch Blanket:
1. Place mulch blanket over seed and extend ends into both trenches.
2. Fill upstream trench with earth and downstream trench with plain riprap.
3. Ensure continuous contact between mulch blanket and soil.
4. When required, overlap adjacent rolls of mulch blanket a minimum of 18 inches.
5. Staple mulch blanket at 2-foot intervals. Place additional staples as necessary.

G. Maintenance: Regrade, relay riprap, geotextile fabric, and mulch blanket, reseed and refertilize as necessary to establish a uniform and stable grassed area.

3.18 TILE DRAIN OUTLETS

A. Installation:
1. In accordance with Division 31 Section "Excavation and Fill for Utilities."
2. Backfill with suitable material.
3. Minimum pipe slope: 0.10%.
4. Extend to prevent erosion of the channel bank.
5. Joints:
   a. Like Materials: Manufactured connector.
   b. Unlike Materials: Wrap with geotextile fabric and pour concrete collar to form a soil tight joint.
6. Outlet Protection: Splash pad in accordance with Division 31 Section "Riprap."

3.19 DITCH CROSSINGS

A. Banks of Ditches Disturbed Under This Work:
1. Protect within 24 hours after a disturbance unless otherwise approved by Engineer.
2. In no case shall banks be left unprotected more than 7 days.

3.20 BUILDING PROJECT CONSTRUCTION

A. During construction conform to the following general rules:
   1. Minimize the amount of earth disturbed at any one time.
   2. Establish a construction sequence which includes adequate erosion control.
   3. As much as practical, direct stormwater away from the construction area. Direct diverted stormwater to a stable on-Site area.
   4. Collect runoff from the Site in sediment basins, traps or through filters.
   5. Establish an inspection and maintenance schedule, paying special attention to the beginning of the various stages of construction.

3.21 OPEN CHANNEL EXCAVATION

A. Power equipment such as bulldozers shall not enter the water unless approved by Engineer.

B. Complete excavation, clearing, grubbing, snagging, tree cutting, pulling, raking, and related work in such a way as to minimize erosion of soil in the areas in which work is completed.

C. Construct sediment basins prior to excavation.

D. Comply with measures for soil erosion and sediment control as indicated on the Drawings.

3.22 AIRBORNE SEDIMENT

A. Dust Control:
   1. Use legal means necessary to control dust on and near the Work and on and near off Site borrow areas if such dust is caused by Contractor's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Treat haul roads, delivery roads, temporary Site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site, and as directed by Engineer.
   3. Periodically scrape and broom adjacent streets and paved areas to remove tracked dirt.

B. Wind Erosion:
   1. Erect and maintain barriers to prevent migration of windblown sediment offsite.
   2. Conduct operations in such a manner as to minimize the amount of Site area exposed to wind erosion.
   3. Be responsible for removal of windblown sediments deposited off Site, including costs for cleaning or repairs required due to sediment deposition and removal.

END OF SECTION 31 25 00

SECTION 31 37 00 – RIPRAP

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Preparation of subgrade.
   2. Geotextile liner.
   3. Riprap.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standards/Test Methods:
      a. ASTM D3786 - Bursting Strength of Textile Fabrics – Diaphragm Bursting Strength Tester Method.
      b. ASTM D4491 - Water Permeability of Geotextiles by Permittivity.
      c. ASTM D4533 - Trapezoid Tearing Strength of Geotextiles.
      d. ASTM D4632 - Grab Breaking Load and Elongation of Geotextiles.
      e. ASTM D4751 - Determining Apparent Opening Size of a Geotextile.
      f. ASTM D4833 - Index Puncture Resistance of Geomembranes and Related Products.
      g. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
      h. ASTM D5261 - Standard Test Method for Measuring Mass per Unit Area of Geotextiles.
   2. AASHTO: M288 - Geotextiles Used for Subsurface Drainage Purposes.
   3. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 DELIVERY, STORAGE AND HANDLING

A. Geotextile liner shall be delivered in original, unbroken, brand-marked wrapping indicating Manufacturer's name and Product description.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.5 SUBMITTALS

A. Action Submittals:
   1. Product Data for Each of the Following:
      a. Geotextile liner.
      b. Riprap source and gradation.
      c. Grout.
   2. Shop Drawings for Precast Concrete Blocks:
      a. Dimensions.
      b. Details of construction and installation.
      c. Concrete used.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Geotextile Liner:
1. Type: Nonwoven.
2. Physical Requirements Schedule:

	Heavy Riprap	Plain Riprap/ Cobblestone
Grab Tensile Strength (Min.), lbs. ASTM D 4632	270	200
Trapezoid Tear Strength (Min.), lbs. ASTM D 4533	100	75
Puncture Strength (Min.), lbs. ASTM D 4833	100	75
Mullen Burst Strength (Min.), lbs. ASTM D 3786	400	200
Permittivity Per Second, Sec. ASTM D 4491	0.5	0.5
Apparent Opening Size (Max.), mm ASTM D 4751	0.21	0.21
In accordance with MDOT Table 910-1		

3. Manufacturers:
   a. Propex, Geotex.
   b. TenCate, Mirafi.
   c. Or equal.

B. Cobblestone:
1. Naturally occurring, sound, tough and durable rock. Not containing soil.
2. Rounded or semi-rounded rock or rock fragments with an average dimension from 3 to 12 inches.

C. Riprap:
1. Rock: Naturally occurring, sound, tough and durable rock including fieldstone, limestone or other quarry rock. Not containing soil.
2. Broken Concrete: Sound pieces free from structural defects. Not containing soil, HMA or protruding reinforcing steel.
3. “Footprint” Dimension of Each Piece:
   a. Plain Riprap: 8 inches minimum to 16 inches.
   b. Heavy Riprap: 16 inches minimum, with a maximum to minimum dimension ratio no greater than 3 to 1.
4. Thickness Dimension of Each Piece:
   a. Plain Riprap: 8 inches minimum.
   b. Heavy Riprap: 8 inches minimum.
5. Smaller pieces may be used for filling spaces between rocks.
6. Precast Concrete Blocks:
   a. Concrete: MDOT Grade P2.
   b. Surface Area:
      1) Maximum:
         a) Plain Riprap: 15 square feet.
         b) Heavy Riprap: 20 square feet.
      2) Randomly scored with plane of weakness joints into sections of:
         a) Minimum Area: 4 square feet.
         b) Maximum Area: 9 square feet.
   c. Minimum Dimension (Thickness):
      1) Plain Riprap: 6 inches.
      2) Heavy Riprap: 16 inches.
   d. Lifting lugs, cast into concrete blocks, shall not project above the finished surface.

PART 3 - EXECUTION

3.1 PREPARATION

A. Grading:
1. Excavate or fill to the required subgrade and dispose of surplus excavated material in accordance with Division 31 Section “Grading.”
2. Slope bank to a minimum slope of 1-1/2 horizontal to 1 vertical.
3. Compact subsurface to 90% of Maximum Unit Weight.
4. Tolerance: +0.2 feet from plan grade.

3.2 INSTALLATION

A. Geotextile Liner:
1. Required where indicated on Drawings only.
2. Place geotextile prior to riprap and secure against movement during placement of riprap.
3. Place geotextile in a key trench at the toe of the slope if the riprap ends at or below a high water elevation. Construct the key trench to 1-1/2 feet deep and wide, or three times the minimum riprap dimension, whichever is greater. Backfill trench with riprap.
4. Place riprap onto geotextile without dumping or dropping riprap into place.
5. After riprap is in place, anchor geotextile in a key trench at the tops of slopes 3 horizontal to 1 vertical or steeper. Backfill trench with soil or riprap.
6. Overlap At Seams: 2 feet minimum, with overlap in the direction of flow.
7. Follow Manufacturer’s installation guidelines.

B. Riprap:
1. Thickness of Treatment:
a. Cobblestone: 6 inches minimum.
b. Riprap: 8 inches minimum.
c. Heavy Riprap: 16 inches minimum.
d. Concrete blocks: In accordance with dimensions in Paragraph 2.1.
2. Cobblestone and Rock:
a. Place beginning in the trench at the toe of slope and progress up slope.
b. Place individual stones, embedding each stone into the slope, and interlock against adjoining stones.
c. Compact as construction progresses.
d. Fill voids with smaller pieces, as approved by Engineer.
e. Measured perpendicular to the slope.
3. Broken Concrete:
a. Place instead of rock with Engineer's approval only.
b. Place with minimum thickness perpendicular to slope.
c. Place beginning at toe of slope and progress up slope.
d. Place to present an even, tight surface.
e. Place heavy riprap in 2 layers with staggered joints.
f. Fill all voids as required by Engineer.
4. Precast Concrete Blocks:
a. Placed instead of rock with Engineer's approval only.
b. Place with minimum thickness perpendicular to slope.
c. Place beginning at toe of slope and progress up slope.

3.3 MAINTENANCE

A. Replace dislodged or missing riprap and restore torn or dislocated geotextile liner to maintain a uniform riprapped area until final completion.

END OF SECTION 31 37 00

SECTION 32 11 23 – AGGREGATE BASE COURSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes furnishing and installation of the major items listed below:
   1. Base course.
   2. Subbase.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following:
   1. ASTM Standard Test Methods:
      a. D1556 - Density and Unit Weight of Soil In Place by the Sand-Cone Method.
      b. D1557 - Laboratory Compaction Characteristics of Soil Using Modified Effort.
      c. D2922 - Density of Soil and Soil-Aggregate In Place by Nuclear Methods.
   2. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 DEFINITIONS

A. Terms:
   1. Base Course: The layer of specified material of designed thickness placed on a subbase or a subgrade to support a surface course.
   2. Pavement Structure: Combination of subbase, base course, and surface course, including shoulders, placed on a subgrade.
   3. Plan Grade: Vertical control grade indicated on the Drawings.
   4. Roadbed: The portion of the roadway between the outside edges of finished shoulders, or the outside edges of berms back of curbs or gutters, when constructed.
   5. Roadside: The portion of the right-of-way outside of the roadway.
   6. Roadway: The portion of the right-of-way required for construction, limited by the outside edges of slopes and including ditches, channels, and all structures pertaining to the Work.
   7. Shoulder: The portion of the roadway contiguous with the traveled way for accommodation of stopped vehicles, for emergency use, and for lateral support of base and surface courses.
   8. Subbase: The layer of specified material of designed thickness placed on the subgrade as a part of the pavement structure.
   9. Subgrade: The portion of the earth grade upon which the pavement is to be placed.

1.5 SUBMITTALS

A. Action Submittals: For aggregate:
   1. Source.
   2. MDOT classification.
   3. Sieve analysis.

1.6 QUALITY ASSURANCE

A. Testing of Aggregate Materials: In accordance with Division 01 Section " Testing Services for Buried Utilities, Roadways, and Site Projects."

B. Compaction:
   1. Determine density by the modified Proctor method, ASTM D1557.
   2. Compact subbase and base course to at least 98% maximum density at a moisture content not greater than optimum.

1.7 PROJECT CONDITIONS

A. Dust Control:
   1. Use all legal means necessary to control dust on and near the Work and on and near off-site borrow areas if such dust is caused by Contractor's operations during performance of the Work or if resulting from the condition of the Site when earthwork operations are suspended.
   2. Moisten or otherwise treat haul roads, delivery roads, temporary Site access roads and other surfaces as required to prevent dust from being a nuisance to the public, neighbors, and concurrent performance of other work on the Site.

B. Existing Utility Structures:
   1. Where utility structures are encountered which are in active use:
      a. Provide adequate protection.
      b. Be responsible for damage.
   2. Adjust utility structures to meet plan grade.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
   1. Approval Required: Material shall be subject to the approval of independent testing laboratory.
   2. Notification: For approval of materials, notify independent testing laboratory at least 1 week in advance of intention to import material, designate the proposed stockpile area, and permit independent testing laboratory to sample as necessary from the stockpile area for the purpose of making acceptance tests to prove the quality of the material.

B. Subgrade: In accordance with Division 31 Section “Grading.”

C. Material Source: Imported Material:
   1. Subbase.
   2. Base course.

D. Subbase:
   1. MDOT 902, Granular Material Class II.
   2. Thickness compacted in place: 12 inches.

E. Aggregate Base Course:
   1. MDOT 902, Dense Graded Aggregate 21AA.
   2. Thickness Compacted in Place: 8 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Subgrade:
   1. Prepared in accordance with Division 31 Section “Grading.”
   2. Maintain in a smooth and compacted condition until the subbase or base course has been placed.
   3. Proof roll subgrade prior to placing subbase or base course.
   4. No base course shall be placed on the subgrade until it has been approved by Engineer.

3.2 INSTALLATION

A. Subbase:
1. Smooth, spread and compact.
2. Place in one layer, provided that the depth of the compacted layer does not exceed 15 inches.
3. Where the specified depth of subbase is more than 15 inches, place material in layers of approximately equal thickness.
4. Construct to the grade and cross section as indicated on the Drawings.
5. Should the subgrade at any time prior to or during the placing of subbase become soft or unstable to the extent that rutting occurs in the subgrade or to the extent that subgrade material is forced up into the subbase materials, the operation of hauling and placing subbase shall be immediately discontinued. Where subgrade material has become mixed with the subbase material, the mixed material shall be removed and disposed of. After the subgrade has been corrected to the specified condition, new subbase material shall be placed and compacted as specified above.
6. Shape to specified crown and grade within a tolerance of plus 1-inch and maintain in smooth condition.
7. Do not place on a frozen, soft, unstable or rutted subgrade.
8. Remove, dispose of and replace subbase material, at Contractor's expense, if it becomes mixed with subgrade material.
9. Proof roll subbase prior to installation of base course.

B. Base Course:
1. Do not place aggregate base on frozen, soft, unstable or rutted subgrade, subbase, or aggregate base.
2. Additives may be used to ease compaction, shaping, and maintenance of the aggregate surface.
3. Do not rut or distort the subbase material or aggregate base during spreading.
4. Place in uniform layers to such a depth that when compacted, the course will have the thickness indicated on the Drawings.
5. The compacted depth of each layer shall not be more than 6 inches nor less than 3 inches.
6. Compact each layer of aggregate.
7. Place aggregate shoulder material in conjunction with the top layer of aggregate base material.
8. Shape to the crown and grade within a tolerance of ± 0.05 feet unless otherwise specified. The surface of each spreading operation shall be continuously maintained in a smooth condition.
9. Roll the shaped surface, when required, to provide thorough compaction.
10. Where the existing surface is very irregular, the use of a scarifier may be required. Wetting may be required to facilitate shaping the surface and to assist in providing compaction.
11. Remove, dispose of and replace aggregate base material, at the Contractor's expense, if it becomes mixed with the subbase or subgrade material.
12. Final shaping and compacting shall be accomplished by use of a subgrade machine operating on crawler tracks, or by the use of a maintainer or surface planer, with a rigid frame.
13. If the subgrade, subbase, or aggregate base is damaged due to the Contractor's operations or by traffic, restore to the specified condition at Contractor's expense.

END OF SECTION 32 11 23

SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the Hot Mix Asphalt (HMA) base course, HMA leveling course, and HMA surface course.

1.3 REFERENCES

A. Comply with standards in effect as of the date of the Contract Documents except for those having different revision dates as referenced in the codes or as indicated on the Drawings.

B. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM - Current Standards:
      a. D977 - Standard Specification for Emulsified Asphalt.
      b. D979 – Sampling Bituminous Paving Mixtures.
      c. D1188 - Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
      d. D2041 – Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixture
      e. D2950 - Test Method for Density of Bituminous Concrete in Place by Nuclear Method.
      f. D2995 - Estimating Application Rate of Bituminous Distributors.
   2. Asphalt Institute (AI):
      a. MS-2 Mix Design Methods.
      b. SP-1 Performance Grade Asphalt Binder Specification and Testing.
      c. IS-210 Procedures for Improving the Precision of HMA Volumetric Calculations.
   3. AASHTO – Current Standards:
      a. M 323 Standard Specification for Superpave Volumetric Mix Design.
      b. MP-1 Superpave Performance-Graded Binder Specification.
      c. MP-15 Use of Recycled Asphalt Shingles as an Additive in HMA Mixtures.
      d. PP-53 Design Considerations When Using Recycled Asphalt Shingles in New HMA Mixtures.
      e. T 245 – Resistance to Plastic Flow of Bituminous Mixtures using a Marshall Apparatus.
      f. T 283 - Moisture Susceptibility of Asphaltic Concrete Mixtures.
      g. T 304 - Uncompacted Void Content of Fine Aggregate, Method A.
      h. T 312: Preparing and Determining the Density of Hot-Mix Asphalt Specimens by Means of the Superpave Gyratory Compactor.
   4. United States Department of Transportation - Federal Highway Administration:
      a. Manual on Uniform Traffic Control Devices (MUTCD).
   5. State DOT Current Standards:
      a. Standard Specifications for Construction.
      b. Standard Plans.
      c. Design Pavement Guidelines
      d. Manual on Uniform Traffic Control Devices.

1.4 SUBMITTALS

A. HMA Mix Design:
   1. Job Mix Formula (JMF) previously approved by state DOT.
      a. Michigan DOT Form 1931
      b. Other States: Submit state DOT form indicating preapproved DOT mix design and required documentation.

2. Job Mix Formula (JMF) not previously approved by state DOT:
   a. Michigan: MDOT 1855 mod form or Form 1911 with regression table.
   b. Other States: Submit DOT or other suitable bituminous mix design communication with all required information to evaluate mix design in accordance with current standards
3. Aggregates:
   a. Source, type, gradation and other required information to evaluate aggregates in accordance with current standards.
   b. Certification that aggregates used in HMA mix meet DOT specifications.

B. Quality Assurance/Control Submittals: Contractor's Quality Control Plan for projects with more than 1,500 tons or greater than 1 day paving

C. Provide a detailed schedule for construction.

1.5 QUALITY ASSURANCE

A. Pre-Paving Meeting:
1. Required for projects greater than 1,500 tons or more than 1 day paving;
2. Optional for projects less than 1,500 tons or 1 day paving.
3. Meeting held at a time mutually agreed upon with Engineer, Owner (optional), Contractor and subcontractors involved in the paving work.
4. Discussion of proposed schedule and methods of accomplishing all phases of the paving work.
5. Minutes distributed to all in attendance.

B. Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design.

C. Testing of HMA Materials:
1. In accordance with Division 01 Section "Testing Services for Buried Utilities, Roadways, and Site Projects."
2. In accordance with approved Contractor's Quality Control Plan.
3. In accordance with all applicable standards.

D. Weight Slips: Furnish weight slips to Engineer, or engineer's representative for material incorporated in the Project to verify that the required tonnage has been applied.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation.

B. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reclaimed Asphaltic Materials (RAM):
1. Reclaimed Asphalt Pavement (RAP) and/or Fractionated Reclaimed Asphalt Pavement (FRAP) as percent of total weight of the mixture:
   a. HMA Base: Maximum 35%. State DOT blending requirements; AASHTO M323.
   b. HMA Binder/Leveling: Maximum 25%. Use virgin binder one grade softer, for both high and low temperature, than specified if RAP greater than 20%.
   c. HMA Surface: Maximum 20%. No change in binder selection.
   d. HMA Mixtures With Polymer Asphalt: Maximum 10%.
   e. Greater than 25% RAP/FRAP or Combination: Use virgin asphalt binder grade in accordance with State DOT blending requirements and AASHTO M 323.

2. Reclaimed Asphalt Shingles (RAS):
   a. In accordance with State DOT requirements.
   b. May replace up to 5% of RAP/FRAP component in HMA mixture.
   c. Maximum Particle size = 1/2 inch.
   d. Maximum deleterious materials = 1.5%
3. Bond Coat: SS-1h, CSS-1h.
4. Leveling Course:
   a. HMA Mixture: 4EL.
   b. Asphalt Cement PG: 58-22.
   c. Air voids modified to 3% using regression for light traffic applications.
5. Top Course:
   a. HMA Mixture: 5EL.
   b. Asphalt Cement PG: 58-22.
   c. Air voids modified to 3% using regression for light traffic applications.

2.2 EQUIPMENT

A. Pavers:
1. Provide an approved self-powered machine capable of spreading and finishing the bituminous mixture to the cross section and grade as indicated on the Drawings.
   a. Supporting wheels, treads, or other devices that ride on the prepared base.
   b. Screeds the full width of the bituminous mixture being applied using an oscillating or vibrating screed.
   c. Equipped with a hopper and an automatic material-depth control device so that each distributing auger and corresponding feeder responds automatically to provide for a constant level of mix ahead of the screed unit to the full width being paved.
2. Provide paver with approved automatic screed control:
   a. System of sensor-operated devices, which follow reference lines or surfaces on one or both sides of the paver.
   b. Adjust speed of the paver to produce the best results.
3. When approved extensions are added to the main screed, provide with the same vibrating screed or tamper action as the main unit of the paver, except for paving variable width areas.
   a. Equip the extensions with a continuation of the automatically controlled spreading augers to within 18 inches of the outside edge of the extension, or as directed.
   b. Provide the main screed and any extensions with an approved method of heat distribution and retention.
4. For Shoulders and Widening:
   a. A self-propelled mechanical spreader capable of maintaining the proper width, depth, and slope without causing segregation of the material.
   b. For base courses up to 10-1/2 feet in width and for leveling and top courses up to 8 feet in width.

B. Rollers:
1. Provide rollers and maintain rolling patterns to achieve required densities to produce a neat, tightly bonded joint that meets surface tolerances
2. Steel-Wheeled Rollers:
   a. Self-propelled, vibratory or static, tandem rollers; or self-propelled static 3-wheeled rollers.
   b. Vibratory Rollers:
      1) Capable of reversing without backlash and equipped with spray attachment for moistening all rollers and scrapers.
      2) Frequency of at least 2,400 vpm and amplitude setting low.
      3) Equipped with a shutoff to deactivate the vibrators when roller speed is less than 0.5 mph and provision to lock in the manufacturer's recommended speed.
3. Pneumatic-Tired Rollers:
   a. Self-propelled type with a total weight, including ballast, not less than 8 tons nor greater than 30 tons.
   b. Equipped with a minimum of 7 wheels situated on the axles in such a way that the rear group of tires will not follow in the tracks of the forward group, but will be so spaced that a minimum tire path overlap of 1/2-inch is obtained.
   c. Smooth tires capable of being inflated to the pressure recommended by the Manufacturer of the roller or as directed.
   d. Tire Pressures: Maximum variation 5 psi.

PART 3 - EXECUTION

3.1 PREPARATION

A. Test subgrade, subbase or aggregate base for density.
   1. Rework surfaces that have become too wet or dry to provide the required density. Do not pave on wet or saturated aggregates.
   2. Required Density: Minimum 95% of Maximum Density ASTM D1557.

B. Proof or Test Rolling:
   1. Field test the uniformity and stability of the subgrade and subbase.
   2. Loaded dump truck or other approved equipment over entire area in each of 2 perpendicular directions.
   3. Areas indicated or as designated by Engineer or field representative.
   4. In presence of Engineer or field representative.
   5. Repair/undercut unstable or yielding areas as directed.

C. Fine Grading:
   1. Immediately prior to placing paving materials, test the subgrade or aggregate base course for conformity to the elevations and cross-section as indicated on the Drawings.
   2. Fine grade as necessary to bring base course into conformance with the proper elevation and cross-section.
   3. Compact areas which have been re-graded to minimum 95% Maximum Density ASTM D1557.

D. Do not place HMA material until the surface to be paved upon has been inspected and approved by Engineer.

E. Immediately before placing the bituminous material, remove excess loose material remaining on the surface.

3.2 INSTALLATION

A. Weather and Seasonal Limitations:
   1. As required by DOT Construction Specifications.
   2. Do not schedule paving if local radar shows rain in forecast, unless paving can be completed prior to rain event.

B. Transportation of Mixtures
   1. Use trucks that have tight, clean, smooth metal beds from which the entire quantity of the mixture is discharged smoothly into the spreading equipment.
   2. Maintain temperature of the mixture discharge from the hauling unit at the target placement temperature or as directed.
      a. Acceptance Range for HMA at Point of Discharge:
         1) Minimum 250 degrees F to maximum 350 degrees F.
         2) HMA mixes less than 250 degrees F or greater than 350 degrees F at point of discharge:
            a) Do not place mix unless approved by Engineer.
            b) Remove mix from Site and dispose off Site unless approved by Engineer.
            c) No additional cost to project.
      b. If transporting at prevailing temperature below 50 degrees F or when haul times exceed 30 minutes, insulate truck beds and ensure all covers are fastened.
   3. Apply approved release agent to hauling unit to prevent adhesion of the mixture to the bed surface.

C. Placement of the Mixture:
   1. To the fullest extent practicable, spread all mixtures with an asphalt paver.
      a. In areas inaccessible to a paver, mixtures may be spread with a motor grader or mechanical device approved by the Engineer.
      b. Complete placement of each course over the full width of the section under construction on each day's run unless otherwise directed by the Engineer.
   2. Provide a uniformly finished surface at all times, free from tearing or other blemishes that would require hand work.
   3. Spread all mixtures without segregation to the cross sections indicated on the Drawings.

4. When paving ramps or shoulders, or when the grade of a concrete gutter or other existing installation must be met, use the automatic grade reference and slope control devices as directed.
5. Whenever a breakdown or malfunction of the automatic controls occurs, operate the equipment manually for the remainder of the normal working day, provided this method of operation will produce results as required.
6. Coordinate the spreading of the mixture with the required roller coverage, considering the rate of cooling of the mixture as affected by lift thickness and environmental conditions.
7. Coordinate the work such that at the completion of each day's paving operations, all lanes will have been resurfaced to within 1 load of the same point-of-ending.

D. Placing Bituminous Leveling and Top Course Mixtures:
1. Place HMA in lifts not to exceed the maximum application rates as recommended by State DOT for the mixture specified.
2. Place the HMA mixture by an approved self-propelled mechanical paver to such a depth that when compacted, it will have the thickness specified or as directed
3. Adjust the paver to that speed which gives the best results for the type of paver being used and which coordinates satisfactorily with the rate of delivery of the mixture to the paver to provide a uniform rate of placing the mixture without intermittent operation of the paver.
4. When delays result in slowing paving operations such that the temperature of the mat immediately behind the screed falls below 200 degrees F:
    a. Stop paving and place a transverse construction joint.
    b. If the temperature of the mat falls below 190 degrees F prior to any rolling - remove and replace the mat at Contractor's expense.
5. Place the HMA mixture to the required cross section and as indicated on the Drawings.
6. Whenever the temperature of the previously placed mat falls below 170 degrees F prior to placement of the adjacent mat:
    a. Tack coat the vertical edges of the initial mat with bituminous bond coat material before the mixture is placed on the adjacent section.
    b. In placing the mixture adjacent to joints, and rake or broom to provide a dense smooth connection.
7. Connections with existing surfaces at the beginning and ending of resurfacing sections and at intersections.
    a. Construct by feathering out the mix at the rate of approximately 1-inch per 25 feet, unless butt joints are used.
    b. After compaction has been completed, spray the first 3 feet of the joint and 1-foot of area not surfaced with bituminous bond coat, sanded, and rolled.
    c. This work shall be accomplished within the concurrent construction season.
8. If the lanes are being constructed with 2 or more pavers in echelon, match the loose depth of bituminous mixture from each paver at the longitudinal joints.
9. Thickness: In place compacted thickness tested in accordance with ASTM D3549.
    a. Thickness must be within 1/4-inch of specified thickness during both leveling and top course paving.
10. Smoothness requirements: After final rolling, the surface may be tested longitudinally by Engineer using a 10-foot straightedge at selected locations. The variation of the surface from the testing edge for the straightedge between any 2 contacts with the surface shall at no point exceed the following limits:
    a. For HMA Base Course Mixtures:
        1) For Lower Courses: 3/4-inch.
        2) For Top Course: 3/8-inch.
    b. For HMA Leveling and Top Course Mixtures:
        1) Multiple Course Construction: 1/8-inch for top course, 1/4-inch for lower courses.
        2) Single Course Construction: 1/4-inch.
    c. Pavement at castings and valve boxes must be flush or a maximum of 1/4-inch higher than casting. In no case shall casting be higher than pavement.
    d. Any bird bath remaining after 24 hours after a rain event is unacceptable and subject to Engineers direction for remediation. Possible repairs might include saw cut and removal or reheating and rolling pavement to eliminate bird bath.
11. Correct variations in excess of the specified tolerance as directed. Remove and replace pavement as directed by Engineer.
12. Weighing Loads: Each load of bituminous mixture accepted by Engineer shall be weighed to the nearest 20 pounds on an approved scale having an automatic print-out system.

13. Weather and Seasonal Limitations:
    a. Do not place HMA or apply tack/bond coat when precipitation is imminent or when surface moisture will prevent satisfactory curing.
    b. Unless otherwise approved by Engineer in writing, temperature requirements for placing HMA mixtures will be in accordance with the table below.
    c. HMA paving will not be allowed below minimum temperatures in table or when there is frost on or in the grade or on the existing surface.

Target Placement Temperatures			
Temperature of the Surface Being Overlaid	Rate of Application of Bituminous Material (lbs/square yard)		
	<120	120 to 200	> 200
35 to 39			330 degrees F
40 to 49		330 degrees F	315 degrees F
50 to 59	330 degrees F	315 degrees F	300 degrees F
60 to 69	315 degrees F	300 degrees F	285 degrees F
70 to 79	300 degrees F	285 degrees F	270 degrees F
80 to 89	285 degrees F	270 degrees F	270 degrees F
90 and over	270 degrees F	270 degrees F	270 degrees F

E. Rolling:
1. Compact each layer of HMA to the required density, free of all roller marks.
2. Begin rolling of the HMA mixture as soon after placing as it will bear the roller without undue displacement, picking up the mat, or cracking.
    a. Roll longitudinally at the extreme sides of the lanes and proceed toward the center of the pavement, overlapping on successive trips by at least half the width of the drive wheel of the roller.
    b. Complete alternate passes of the roller using slightly different lengths.
3. Complete the required roller coverage during the period of time in which the temperature of the mixture is sufficient for the roller coverage to be effective in compaction of the mixture.
4. Use tandem steel-wheeled rollers for the final rolling operation on each layer of HMA.
5. Keep surface of steel rollers completely moist with water when rolling.
6. Operate vibratory rollers in the static mode when used for finish rolling or pinching the joint.
7. In Areas Inaccessible to Rollers:
    a. Thoroughly compact the mixture with hot, hand tampers or with mechanical tampers.
    b. Trench rollers or rollers filled with compression strips may be used in depressed areas.

F. Bond or Tack Coat:
1. Clean contact surfaces of sand, dirt, or other objectionable material before applying bond coat.
2. Apply to existing bituminous material and to the vertical edge of the adjacent pavement or curb and gutter, prior to applying new bituminous when:
    a. Paving over milled surface.
    b. Paving over old pavement.
    c. Paving over new pavement.
    d. Adjacent pavement face that is below 170 degrees F.
3. Distributor Vehicle:
    a. Use identical overlapping nozzle spray pattern.
    b. Maintain temperature and pressure that result in a constant uniform application rate.
    c. Provide means for determination of the volume of tack applied to a surface area.
4. Apply tack coat to vertical surfaces and provide uniform application.
5. Application Rate:
    a. 0.05 to 0.1 gallons per square yard for paved surfaces.
    b. Increase application rate 20 to 30% for milled or very rough surfaces.

c. Increase application rate 50% for vertical edge of adjacent pavement or structure.
d. Calculate yield by dividing gallons used by square yards covered.

6. Prevent bond or tack coat from coming into contact with structures near the areas to be paved.
7. Allow emulsified asphalt tack coat to break, as indicated by color change from brown to black before HMA paving is placed.
8. Do not place tack coat if local radar shows rain in forecast, unless paving can be completed prior to rain event.

G. Acceptance Density Range:
1. Low Volume Roads/Parking Lots:
   a. Acceptable Range: 93 to 97% of the TMD.
   b. Average Daily Density: ≥ 94%.
2. Medium/Heavy Volume Roads:
   a. Acceptable Range: 92 to 96% of the TMD.
   b. Average Daily Density: ≥ 93%.
3. For smaller projects, the engineer may elect to accept the project without density testing:
   a. Compact all patching, widening, wedging, base, leveling and surface layers of asphalt paving until no further consolidation is visible under the action of the compacting equipment and roller marks are eliminated
   b. Use two or more rollers per paver if placing more than approximately 165 tons of mixture per hour.
   c. Basis of Acceptance: Engineer's visual examination.

H. Construction Joints:
1. Thoroughly compact all joints to produce a neat, tightly bonded joint that meets surface tolerances and density requirements.
2. Transverse Joints:
   a. Construct when mixture placement operations are suspended
   b. Thoroughly compact the forward end by rolling before the mixture has cooled.
   c. When work is resumed, vertically cut the end for full depth of the layer unless a formed edge is constructed as approved by the Engineer.
   d. When road must remain open to traffic construct temporary taper before allowing traffic on new surface:
      1) Cut vertical joint and remove excess HMA.
      2) Place burlap, canvas or paper as a bond breaker ahead of and against the vertical face.
      3) Place HMA against the bond breaker and taper from new mat to existing surface.
      4) Extend temporary taper 5 feet for each inch of mat thickness or as directed by Engineer.
      5) Thoroughly compact and cool the temporary taper.
3. Longitudinal Joints:
   a. Construct parallel to centerline of road.
   b. Multiple Lift Construction: Offset minimum 6 inches from previously placed joint.
   c. Vertical Longitudinal Joint:
      1) Apply uniform tack coat over joint face of existing pavement with a surface temperature less than 170 degrees F.
      2) Place HMA so that it uniformly overlaps the first lane approximately 1 inch
      3) Roll the longitudinal joint from the hot side, 1/2 foot to 1 foot away from the joint for the first pass.
      4) Subsequent Passes: Overlap the cold side by 1/2-foot to 1 foot.
   d. Tapered Overlapping Longitudinal Joint:
      1) Taper the HMA mat at the slope no greater than 1:12.
      2) Extend tapered portion beyond the lane width.
      3) Place 1/2-inch to 1 inch notch at the top of the taper on all courses of paving.
      4) Compact the formed taper section with a weighted roller as wide as the taper.
      5) Apply uniform tack coat to the surface of the taper before the adjacent lane is placed.
   e. Longitudinal Joint Compaction:
      1) Joint Density: Minimum 90% TMD (G_{mm}).
      2) Joint Density with echelon paving; same as adjacent mat.

3.3 CLEANING

A. Prior to acceptance of the work, clean the pavement and related areas to remove dirt and stones.

END OF SECTION 32 12 16

SECTION 32 15 00 – AGGREGATE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Aggregate top course.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standard Test Methods: 1557 - Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb. Rammer and 18-inch Drop.
   2. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 SUBMITTALS

A. Action Submittals:
   1. Aggregate:
      a. Source.
      b. MDOT classification.
   2. Sieve analysis.

1.5 QUALITY ASSURANCE

A. Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design.

B. Testing of Aggregate Materials: In accordance with Division 01 Section “Testing Services for Buried Utilities, Roadways, and Site Projects.”

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during, and after installation and to protect the installed work and materials of all other trades.

B. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Aggregate Top Course:
   1. MDOT 902 Dense Graded Aggregate: 22A.
   2. Thickness Compacted In Place: 4 inches.

PART 3 - EXECUTION

3.1 EXCAVATING, FILLING, AND GRADING

A. Subgrade in accordance with:
   1. Division 31 Section “Grading.”
   2. Division 31 Section “Excavation and Fill for Structures.”
   3. Division 31 Section “Excavation and Fill for Utilities.”

B. Base Course: In accordance with Division 32 Section “Aggregate Base Courses.”

3.2 INSTALLATION

A. Preparation of Subgrade:
   1. Smooth and trim subgrade to the required grade, line, and cross section to receive aggregate.
   2. Compact the subgrade to 95% maximum density as defined in ASTM D1557.
   3. The subgrade shall be smooth and free from irregularities in grade.

B. Placing Surface Courses:
   1. Do not begin paving until subbase and base course have been reviewed by Engineer.
   2. Place each layer uniformly, and shape with grader or other approved equipment until free from waves and irregularities.
   3. The thickness of any one layer shall not exceed 6 inches.
   4. Shape and compact until each layer achieves a compaction of not less than 95% maximum density as defined in ASTM D1557.

3.3 CLEANING

A. Prior to acceptance of the work of this Section, clean the pavement and related areas in accordance with Division 01 Section “Cleaning and Waste Management.”

END OF SECTION 32 15 00

SECTION 32 31 13 – CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of chain link fences and gates.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM:
      a. A90 - Test Method for Weight of Coating of Zinc-Coated (Galvanized) Iron and Steel Articles.
      b. A121 - Zinc-Coated (Galvanized) Steel Barbed Wire.
      c. B545 - Electro-deposited Coatings of Tin.
      d. C1107 - Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
      e. F567 - Installation of Chain-Link Fence.
      f. F626 - Fence Fittings.
      g. F668 - Poly(Vinyl Chloride) (PVC) - Coated Steel Chain Link Fence Fabric.
      h. F900 - Industrial and Commercial Swing Gates.
      i. F1043 - Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
      j. F1083 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
      k. F1183 - Aluminum Alloy Chain Link Fence Frame Fabric.
      l. F1184 - Industrial and Commercial Horizontal Slide Gates.
   2. Institute of Electrical and Electronic Engineers: IEEE C2 - National Electrical Safety Code.
   3. National Fire Protection Association: NFPA 780 - Installation of Lightning Protection System.
   4. Underwriters Laboratories: UL 467 - Safety Grounding and Bonding Equipment.

1.4 DEFINITIONS

A. Corner Posts: Posts located at a change in horizontal alignment.

B. End Posts: Posts located at the beginning or end of a length of fence.

C. Gateposts: Posts which support the weight of a gate. Gateposts may function also as terminal posts but generally are sized differently.

D. Line Posts: Posts between terminal posts.

E. Pull Posts: Posts located within a length of fence at certain distances, and at changes in vertical alignment, to facilitate stretching of fabric.

F. Terminal Posts: Posts set where fence fabric terminates, and between which the fabric is stretched; a term which includes end, corner, and pull posts.

1.5 SUBMITTALS

A. Action Submittals:
   1. Shop Drawings: For fence.
      a. Dimensions.
      b. Anchorage details.

2. Product Data: For fence, post and gate.
   a. Catalog cuts.
   b. Coating data and coating choices.

1.6 PROJECT CONDITIONS

A. Temporary Fences:
   1. Temporary fences shall consist of properly installed and braced snow fence with a minimum height of 4 feet.
   2. Temporary fences shall be installed and removed at no additional cost to Owner.
   3. Temporary fencing shall be installed around well pumps and equipment prior to removing enclosures from around them.
   4. Locate temporary fencing at a sufficient distance from the well pumps and equipment so that construction activities for the facility may proceed without removing any fencing.
   5. Temporary fencing shall remain in place until the well pump and equipment are fully enclosed and secure.
   6. Remove temporary fencing and restore surroundings to original condition.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products of the following Manufacturers, provided they comply with requirements of the Contract Documents, will be among those considered acceptable:
   1. Allied Tube and Conduit Corporation; Harvey, IL 60426.
   2. Anchor Fence, Inc.; Baltimore, MD 21224.
   3. Boundary Fence and Railing Systems, Inc.; Richmond, NY 11418.
   4. Merchant Metals, New Paris, IN 46553.

2.2 COMPONENTS

A. Round Steel Pipe: Standard weight, Schedule 40, galvanized steel pipe complying with ASTM F1083.

B. Fittings:
   1. Material and finish of accessories shall comply with ASTM F626 and shall match fence fabric.
   2. Zinc coating of ferrous accessories: Hot-dip zinc-coated; weight of coating, 1.8 ounces per square foot of coated area, average unless noted otherwise.
   3. Caps:
      a. Formed steel, malleable or cast iron, or aluminum alloy, with ring to receive top rail or loop to receive tension wire according to fence configuration.
      b. Snug-fitting, weathertight closure of posts.
   4. Rail Ends: Formed steel, malleable or cast iron, or aluminum alloy.
   5. Rail Sleeves:
      a. Formed of same material as rail.
      b. Minimum Length: 6 inches.
      c. Rails with 3-inch swaged ends will not require rail sleeves.
   6. Wire Ties and Clips:
      a. Size: Not less than fabric wire gage size.
      b. Minimum Zinc Coating Weight: 0.8 ounce per square foot.
   7. Brace Bands and Tension Bands: 3/4-inch x 1/10-inch thick (nominal).
   8. Tension Bars:
      a. 3/4 x 3/16-inch (or equivalent section) for 2-inch mesh.
      b. Continuous length to match fabric width.
   9. Truss Rods: 5/16-inch minimum diameter rod with turnbuckle.
   10. Fitting for Mechanical Anchorage of Posts: Provide suitable fittings such as base plates, clamps, standoffs, for mechanical anchorage of posts to horizontal, vertical, or inclined surfaces where indicated.

C. Barbed Wire:
   1. Two strand, 12-1/2 gage twisted steel wire with 4-point barbs spaced at no more than 5 inches on center.
   2. Zinc coated, 0.80 ounces per square foot minimum on wire and barbs.
   3. In accordance with ASTM A121.

D. Barbed Wire Support Arms:
   1. Manufacturer's standard article, either attached to posts or integral with post caps.
   2. Molded plastic will not be accepted.
   3. Capable of withstanding 250-pound load applied perpendicular to arm tip.
   4. Securely anchored to posts.
   5. Fitted with clips or slots for attaching barbed wire.
   6. One arm per post with hole for passage of top rail.
   7. Same finish as post caps.
   8. With lockwire to resist removal of barbed wire.

E. Coating:
   1. PVC coating applied by fluidized bed thermally fused method to preheated, cleaned, pretreated, and primed substrate.
   2. Coat fence fabric in accordance with ASTM F668, Class 2B; coat other components to 10 mils thickness minimum.
   3. Coat all fence components completely including, but not necessarily limited to:
      a. Framework.
      b. Fabric.
      c. Bars, bands, rods and wire.
      d. Barbed wire and support arms.
      e. Sleeves, ends, caps, and other fittings and accessories.
   4. Inside of closed tubular members need not be coated.
   5. Color: Chosen by Engineer from manufacturer's standard colors.

F. Swing Gate Hardware:
   1. Hinges:
      a. Sized to suit gate size.
      b. Non-lift-off type.
      c. Centered or offset to permit gate opening (arc) indicated on the Drawings.
      d. Bolted clamp and band assembly.
   2. Manual Gate Latches:
      a. Single Leaf Gate: Forked type.
      b. Double Leaf Gate: Full gate height plunger bar type.
      c. Permit latching and locking operation from either side of gate.
      d. Padlock eye integral part of latch.
   3. Double Leaf Gate Stop:
      a. Mushroom type or flush plate with anchors.
      b. Designed to engage center drop rod or plunger bar.
   4. Keepers:
      a. For each leaf over 5 feet wide.
      b. Mechanical device for securing gate leaf in full open position until manually released.

2.3 FABRICATION

A. Fence Configuration:
   1. Construct Fence With:
      a. Top rail.
      b. Bottom rail.
      c. Bottom of fence fabric 2 inches above grade.
      d. Barbed wire top, 3 strands, inclined outward arm.

B. Fabric:
   1. Material:
      a. Steel, zinc-coated before weaving.
      b. Zinc Coating Weight:
         1) 0.3 ounces per square foot.
         2) In accordance with ASTM F668.
   2. Wire Diameter: 0.148-inch (9 gage) before application of PVC coating.
   3. Mesh Size: 2 inches.
   4. Fabric Width: 96 inches.
   5. Selvage:
      a. Fabric 60 Inches High and Under: Knuckled top and bottom.
      b. Fabric 72 inches High and Over:
         1) Twisted top and knuckled bottom.

C. Fence Framework:
   1. Coating of Steel Pipe:
      a. Interior and Exterior: Hot-dip zinc-coated.
      b. Weight of Coating: 1.8 ounces per square foot of coated area, average.
      c. Tested in accordance with ASTM A90.
   2. Coating of Steel Shapes:
      a. Hot-dip zinc-coated.
      b. Weight of Coating: 1.8 ounces per square foot.
      c. Tested in accordance with ASTM A90.
   3. Top Rail Length: 18-foot minimum lengths.
   4. Light Industrial Category, Group IA:
      a. Conform to ASTM F1043.
         1) Rail Size: 1.660 inches outside diameter x 0.112-inch wall thickness, 1.82 pounds per foot.
         2) Line Posts Size: 2.375 inches outside diameter x 0.123-inch wall thickness, 2.96 pounds per foot.
         3) Terminal Posts Size: 2.875 inches outside diameter x 0.162-inch wall thickness, 4.69 pounds per foot.

D. Gates:
   1. Gateposts:
      a. Steel pipe, coated as specified for fence framework.
      b. Leafs 6'-0" Wide or Less: 2.875 inches outside diameter x 0.203-inch wall thickness, 5.79 pounds per foot.
      c. Leafs Over 6'-0" Up To and Including 13'-0" Wide: 4 inches outside diameter x 0.226-inch wall thickness, 9.11 pounds per foot.
      d. Leafs Over 13'-0" Up To and Including 18'-0" Wide: 6.625 inches outside diameter x 0.280-inch wall thickness, 18.97 pounds per foot.
      e. Leafs Over 18'-0" Wide: 8.625 inches outside diameter x 0.322-inch wall thickness, 28.55 pounds per foot.
   2. Swing Gates:
      a. Comply With ASTM F900.
         1) Type: Double swing.
         2) Frame: Tubular steel, welded or riveted.
         3) Coating as specified for fence framework.
      b. Fabric: To match line fence.
      c. Brace gate or add truss rods to prevent sagging.
      d. Barbed Wire: 3 strands secured to 1-foot extensions of gate frame.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that line of fence has been properly identified.

B. Verify that proper grade has been established.

C. Verify location of underground utilities and structures.

D. Begin fence construction only after adequate clearance on both sides of fence is available.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts.

B. Do not exceed intervals of 500 feet or line of sight between stakes.

C. Indicate locations of utilities, lawn sprinkling system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION

A. Install Chain Link Fence and Gates in Conformance With ASTM F567:
   1. The Shop Drawings reviewed by Engineer.
   2. The Manufacturer's recommendations.
   3. Install fencing on established boundary line inside property line.

B. Posts:
   1. Layout:
      a. Space line posts at equidistant intervals not exceeding 10 feet on center measured parallel to grade.
      b. Locate terminal posts at the beginning and end of each continuous length of fence, at abrupt changes in line or grade, additionally at intervals not to exceed 500 feet, and as otherwise indicated on the Drawings.
      c. Install posts plumb and in proper alignment.
      d. Elevation of fence shall follow ground line unless otherwise indicated on Drawings.
      e. Bottom of fabric shall run at a uniform distance above ground of 2 inches, ±1/2-inch.
   2. Anchorage of Posts in Soil:
      a. Set posts in concrete-filled holes, securely braced in proper position until concrete has cured at least 3 days above 60 degrees F.
      b. Hole shall be free of loose materials when placing concrete.
      c. Hole diameter shall be not less than 4 times largest cross section of post.
      d. Minimum Hole Depth:
         1) Line and Terminal Posts: 36 inches for fence up to 8 feet high.
         2) Gate Posts:
            a) Leafs 6 Feet High or Less: 36 inches for leafs up to 18 feet wide.
            b) Leafs Over 6 Feet High: 36 inches for leafs up to 12 feet wide; 42 inches for leafs over 12 feet to 18 feet wide.
         3) Deeper as required by fence Manufacturer or installer.
      e. Increase hole depth as necessary to provide a least 3 inches of cover under bottom of post. Do not allow posts to contact soil.
      f. Spread waste excavation materials in approved locations, in accordance with Division 31 Sections ”Grading,” “Excavation and Fill for Structures,” and “Excavation and Fill for Utilities.”
      g. Thoroughly consolidate concrete.
      h. Extend concrete 1-inch above grade, forming a crown to shed water.
      i. Plumb posts to 1/4-inch in 10 feet.
   3. Anchorage of Posts in Rock or Concrete:
      a. Set posts in cored holes with grout conforming to ASTM C1107.
      b. Minimum Hole Diameter: 1/2-inch greater than largest post cross-section.
      c. Minimum Hole Depth: Three times largest cross post cross-section.
      d. Crown grout to shed water.

C. Fence:
   1. Cut fabric to form one continuous piece between terminal posts.
   2. Pull fabric taut and secure to rails and tension wires at 1-foot on both sides of each post and at intervals of 24 inches, maximum, on center.
   3. Attach fabric to security side of fence.

4. Secure fabric to line posts with tie wires or clips at intervals of 15 inches, maximum, on center.
5. Secure fabric to terminal posts for the full width of fabric by using stretcher bars and bands or by integrally weaving fabric to fastening loops on posts.
6. Secure each barbed wire strand to each support arm.
7. Field paint bolts and nuts to match PVC coating.

D. Gates:
1. Install gates in accordance with Manufacturer's instructions, plumb and level to 1/4-inch in 10 feet, and secure.
2. Gates shall operate freely without binding or dragging and shall be easily operable by hand.
3. Install ground set items in concrete as recommended by Manufacturer.

3.4 ADJUSTING

A. General:
1. Adjust brace rails and tension rods for rigid installation.
2. Tighten hardware, fasteners, and accessories.

END OF SECTION 32 31 13

SECTION 32 92 00 – TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of the major items listed below:
   1. Seed.
   2. Fertilizer.
   3. Mulch.
   4. Sod.
   5. Dune grass.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. State DOT Current Standards:
      a. Specifications for Construction.
      b. Standard Plans.

1.4 DEFINITIONS

A. Follow-up Maintenance: Maintenance required when seeding, sodding, or other vegetative practices do not achieve the desired degree of stabilization.

B. Periodic Maintenance: Maintenance performed after the vegetation has been established.

1.5 LOCATION

A. Sodded Areas: As indicated on the Drawings.

B. Seeded Areas: All disturbed areas within the project limits not covered by other surface improvements or features.

C. Mulch Blankets: As indicated on the Drawings.

1.6 SUBMITTALS

A. Action Submittals: Product Data for mulch blanket.

B. Informational Submittals:
   1. Samples: For netting and mulch blanket.
   2. Supplier's certified analysis for each seed and fertilizer mixture required.

1.7 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Submittals.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, and damage by weather or elements, and according to Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: In accordance with Division 31 Section “Grading.”

B. Fertilizer:
1. Comply with MDOT 917.10, Class A except as herein specified.
2. Liquid Fertilizer for Hydroseed: 16-32-4 containing no chlorine.

C. Seed:
1. Mixture composed of certified seed of the following purity, germination, and proportions by Weight:
   a. Lawns: TDS, 220 lb/acre.
   b. Roadside: TDS, 220 lb/acre.
   c. Other Areas: TDS, 220 lb/acre.
2. Furnish seed in durable bags, each marked by the supplier of the blended mix with a tag giving name, lot number, net weight of contents, purity, and germination.

D. Mulch:
1. Small Grain:
   a. Straw.
   b. Hay.
2. Anchoring Material for Small Grain Mulch:
   a. Netting:
      1) Biodegradable.
      2) Openings not to exceed 1-1/2 inches x 2 inches.
      3) Minimum Roll Width: 35 inches.
      4) Anchoring Staples or Pins: Wood pegs at least 6 inches long. Steel wire not permitted.
3. Hydromulch:
   a. Slurry: Minimum 60% wood fiber mulch with remaining being recycled cellulose fibers.
   b. Tackifier:
      1) Manufacturers: Finn Fiber Plus; Finn Fiber Gum; or equal.
      2) Synthetic fiber or gum.
4. Mulch Blankets:
   a. Biodegradable:
      1) Straw: North American Green S-75; or equal.
      2) Coconut: North American Green C-125; or equal.
      3) Straw and Coconut: North American Green SC-150; or equal.
   b. Non Degradable Polyester: North American Green P-300; or equal.
   c. Anchoring Staples or Pins:
      1) Hardwood stakes at least 6 inches long.
      2) North American Green Bio-Stake blanket pins at least 6 inches long.

E. Sod: Comply with MDOT Section 917.13.

PART 3 - EXECUTION

3.1 TOPSOIL

A. In accordance with Division 31 Section “Grading.”

3.2 SEEDBED PREPARATION

A. General:
   1. After the areas to be seeded have been brought to the required grade and properly trimmed, bring soil to a friable condition by disking, harrowing, or otherwise loosening and mixing to a depth of 3 inches to 4 inches. Thoroughly break all lumps and clods.
   2. If the prepared seedbed is not fertilized, satisfactorily seeded, and mulched before the friable condition is lost through compaction or crusting, repeat the seedbed preparation prior to seeding or reseeding.

B. Raking: Rake prepared seedbed before seeding.

3.3 FERTILIZING

A. Dry Fertilizer:
   1. Broadcast on surface as first step in seeding process.
   2. Apply with seeding if drilled.
   3. Work fertilizer into the soil to a depth of 1-inch to 2 inches.
   4. Apply uniformly.
   5. Application Rate: Equivalent to 240 pounds per acre of 12-12-12.

B. Hydroseeding:
   1. Apply fertilizer with seed.
   2. Application Rate: Equivalent to 6.25 pounds per 1,000 square feet of 16-32-4.

3.4 SEEDING

A. Scheduling:
   1. Within 30 days from the time the area was first disturbed.
   2. Channel Banks: Within 24 hours from the time the area was first disturbed.
   3. Seasonal Limitations:
      a. April 20 through November 1.
      b. Dormant seeding after November 1.

B. Sowing:
   1. Sow the seed following or in conjunction with the fertilizer and while the seed bed is in a friable condition.
   2. Do not sow seeds through mulch.
   3. Application Rate:
      a. Lawn Areas: Sow seed at a minimum rate of 220 lbs. per acre.
      b. Other Areas: Sow seed at a minimum rate of 220 lbs per acre.

C. Finishing: Float and lightly compact areas sown by hydro-seeder or the broadcast method to incorporate the seed into the uppermost 1/2-inch of the soil.

D. Method:
   1. Broadcast: Do not seed when wind velocity exceeds 5 miles per hour.
   2. Mechanical drills.
   3. Hydroseeder:
      a. Use only equipment specifically designed for hydraulic seeding application.
      b. Mix seed, fertilizer and pulverized mulch in water until uniformly blended into homogeneous slurry.
      c. Continue mixing during application.

E. Inspection: Areas which are sown by hydro-seeder or the broadcast method shall be visually inspected for uniformity of application; areas in which visual inspection fails to reveal an average of 2 seeds per square inch shall be resown at no additional cost to Owner.

F. Seed on Slopes: Protect seeded slopes against erosion with netting, asphalt emulsion adhesive or other methods acceptable to Engineer. or Protect seeded slopes against erosion with mulch blanket.

3.5 MULCHING

A. Small Grain Mulch:
   1. Application:
      a. Immediately after seeding.
      b. Uniform distribution.
      c. Allow sunlight to penetrate mulch.
   2. Application Rate: Two tons per acre (2-1/2 bales per 1000 square feet).
   3. Anchoring:
      a. Mulch anchoring tool.
      b. Netting.

B. Hydromulch:
   1. Apply with hydroseed or following seeding by other method.
   2. Application Rate: 1,250 pounds per acre.
   3. Do not apply if rain is anticipated within 24 hours. Reapplication is required after rain damage at Contractor’s expense.

C. Mulch Blankets:
   1. Netting on top.
   2. Fibers in direct contact with soil.
   3. Staple in accordance with Manufacturer's guidelines for slope conditions.
   4. Direction of Installation:
      a. Direction of flow of water in intermittent and ephemeral drains.
      b. Perpendicular to sideslopes above normal water level in perennial drains.

3.6 SOD BED PREPARATION

A. Make Area to be Sodded:
   1. Smooth and uniform.
   2. Parallel to the finished grade and cross sections indicated on the Drawings.

3.7 LAYING SOD

A. General:
   1. Moisten sod and place on a moist earth bed.
   2. Lay sod within 24 hours after cutting and properly protect it until placed.
   3. Carefully place the sod by hand in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward.
   4. Do not use pitch forks to handle sod. Dumping from vehicles will not be permitted.
   5. Extend bottom edge of sodded areas at least 2 inches into the ground or ditch bottom.
   6. Break transverse joints of sod strips and carefully lay sod to produce tight joints.
   7. When the sod may be displaced during sodding operations, work from ladders or treaded planks.
   8. Firmly compact the sod by tamping immediately after it is placed.
   9. After tamping, the sod shall present a smooth, even surface free from bumps and depressions.

B. Sod on Slopes:
   1. On slopes steeper than 1 vertical to 3 horizontal, peg the sod with wooden pegs.
   2. Space pegs not over 2 feet apart in any direction.
   3. Drive pegs flush with the surface of the sod.

C. Frozen Materials:
   1. Do not place frozen sod.
   2. Do not place sod on frozen soil.

D. Watering: After placing sod, water with an initial application of 15 gallons per 100 square feet.

3.8 MAINTENANCE

A. General:
   1. Contractor: Responsible for follow-up maintenance.
   2. Contractor is responsible for periodic maintenance for 60 days after completion of areas of seeding or sodding.

B. Follow-up Maintenance:
   1. Inspect materials planted in the spring during the summer or early fall, and take corrective action during the fall planting season.
   2. Inspect materials planted in the fall during the spring and take corrective action during this spring planting season.
   3. Reseed, sod, plant, fertilize, mulch, topsoil, grade and roll as necessary to achieve a uniform lawn free from eroded or bare areas.
   4. Water sodded and seeded areas as required to maintain the viability of the Product.

C. Periodic Maintenance:
   1. Mow grass at 3-inch to 3-1/2-inch height and subsequent mowings as required to maintain 1-1/2-inch to 2-inch height.
   2. Spot seed areas damaged by traffic or other means.

END OF SECTION 32 92 00

SECTION 33 10 00 – WATER UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of a water distribution system.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ASTM Standard Specifications:
      a. A48 - Grey Iron Castings.
      b. A126 - Grey Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A167 - Standardized Specification for Stainless and Heat-Resistant Chromium-Nickel Steel Plate, Sheet, and Strip.
      d. A240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels.
      e. B62 - Composition Bronze or Ounce Metal Castings.
      f. B88 - Seamless Copper Tube.
      g. C478 - Precast Concrete Manhole Sections.
      h. C923 -Standard Specification for Resilient Connectors Between Reinforced Concrete manhole Structures, Pipes, and Laterals.
      i. D429 - Rubber Property-Adhesion to Rigid Substrates.
      j. D449 - Asphalt Used in Dampproofing and Waterproofing.
      k. D1248 - Polyethylene Plastics Molding and Extrusion Materials.
      l. D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
      m. D1785 - Standardized Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80 and 120.
      n. D2657 – Standard Practice for Heat Fusion Joining of Polyolefin Pipe.
      o. D3035 - Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
      p. D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.
      q. F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
      r. F2164 - Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping Systems Using Hydrostatic Pressure.
   2. ANSI/AWWA:
      a. C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
      b. C105/A21.5 - Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
      c. C110/A21.10 - Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
      d. C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
      e. C116/A21.16 – Protective Fusion-Bonded Coatings for the Interior and Exterior Surfaces of Ductile-Iron and Gray-Iron Fittings.
      f. C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
      g. C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids.
      h. C153/A21.53 - Ductile-Iron Compact Fittings, 3-inch through 24-inch (76 mm through 610 mm), and 54-inch through 64-inch (1,400 mm through 1,600 mm) for Water Service.
      i. C301 - Prestressed Concrete Pressure Pipe, Steel-Cylinder Type, For Water and Other Liquids.
      j. C304 - Design of Prestressed Concrete Cylinder Pipe.

3. AWWA Standards/Manuals:
   a. C502 - Dry-Barrel Fire Hydrants.
   b. C504 - Rubber-Seated Butterfly Valves.
   c. C506 - Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Type.
   d. C511 - Reduced Pressure Principle Backflow Prevention Assembly.
   e. C512 - Standard for Air Release, Air/Vacuum and Combination Air Valves for Waterworks.
   f. C515 - Reduced Wall, Resilient Seated Gate Valves for Water Supply Service.
   g. C550 - Standard for Protective Epoxy Interior Coating for Valves and Hydrants.
   h. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
   i. C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
   j. C651 - Disinfecting Water Mains.
   k. C700 - Cold Water Meters - Displacement Type, Bronze Main Case.
   l. C701 - Cold Water Meters - Turbine Type for Customer Services.
   m. C702 - Cold Water Meters - Compound Type.
   n. C706 - Direct-Reading, Remote-Registration Systems for Cold Water Meters.
   o. C800 - Underground Service Line Valves and Fittings.
   p. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 12-inch, for Water.
   q. C905 - Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14-inch through 36-inch
   r. C906 - Standard for Polyethylene (PE) Pressure Pipe and Fittings, 4-inch through 63-inch for Water Distribution.
   s. M23 - PVC Pipe - Design and Installation.
4. DIPRA - Ductile Iron Pipe Research Association.
5. NFPA – National Fire Protection Association.
6. National Sanitation Foundation (NSF) Standards:
   a. 14 – Plastic Piping System Components and Related Materials.
   b. 60 - Drinking Water Treatment Chemicals.
   c. 61 - Drinking Water System Components.

1.4 DEFINITIONS

A. Abbreviations:
   1. DI - Ductile iron.
   2. PVC - Polyvinyl chloride.

1.5 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Pipe.
      b. Gaskets.
      c. Hydrants.
      d. Valves.
      e. Thrust control materials.
      f. Corporation stops.
      g. Curb box.
      h. Curb stop.
   2. Tapping Materials and Methods: Required Information:
      a. Dimensions.
      b. Details of construction and installation.
      c. Name of Manufacturer.
      d. Model.
   3. Procedures: For flushing, pressure testing and chlorinating. Required Information:
      a. Equipment.
      b. Methods.

B. Informational Submittals: Submit Manufacturer's sworn and notarized statements that the materials furnished comply with this Specification.

1.6 QUALITY ASSURANCE

A. Installation Personnel Qualifications:
   1. Trained and experienced in the installation of the materials.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

B. Water Distribution System: Pressure and leak tests.

C. Water Quality: Bacteriological tests.

1.7 PROJECT CONDITIONS

A. Scheduling of Water Shutoffs:
   1. Approval required.
   2. Not to exceed 4 hours.
   3. Standby service may be required by utility agency.
   4. Required Notice:
      a. Fire Department: 48 hours.
      b. Affected Customers: 48 hours.
      c. If local regulations require more notice, the local regulations shall prevail.
   5. Operation of Existing Valves: By Owner's employees only.

B. Contamination of Existing Lines:
   1. Prevent.
   2. Be responsible for all costs of chlorinating and flushing contaminated lines.

PART 2 - PRODUCTS

2.1 PIPE AND FITTING MATERIALS

A. Ductile Iron Pipe:
   1. ANSI/AWWA C150/A21.50 and C151/A21.51.
   2. Pressure Class: PC 350.
   3. Cement Mortar Lining:
      a. ANSI/AWWA C104/A21.4.
      b. Double thickness.
   4. Meet the requirements of ANSI/NSF Standard 61 and the certification must be stamped on the exterior wall of the pipe.
   5. Joints:
      a. ANSI/AWWA C111/A21.11.
      b. Push-on.
      c. Restrained:
         1) 6-Inch Through 24-Inch:
            a) U.S. Pipe: TR Flex Restrained Joint; Field Lok gasket.
            b) American: Flex-Ring Restrained Joint; Fast Grip gasket.
            c) Clow: Super-Lock Restrained Joint.
            d) Griffin Pipe: Snap-lok restrained joint.
            e) Mechanical joint restraint with Megalugs by Ebaa Iron Sales; or equal.
         2) For pipe sizes greater than 24-inch, joints requiring restraint shall be by manufactured restrained joint pipe.
      d. Lubricant: Provide in accordance with Manufacturer’s recommendation.
   6. Polyethylene Encasement: ANSI/AWWA C105/A21.5.

B. Fittings:
   1. All fittings shall be restrained to pipe.
   2. Ductile Iron Fittings:
      a. 6-Inch Through 24-Inch:
         1) ANSI/AWWA C153/A21.53, compact fittings.
         2) Manufactured restrained joint.

3) 350 psi pressure rating.
4) Lining:
a) Standard thickness, cement mortar lining in accordance with AWWA C104.
b) Fusion bonded epoxy in accordance with ANSI/AWWA C116/A21.16, nominal 6-8 Mils.

b. Joint Restraint for Ductile Iron Fittings to Ductile Iron Pipe:
1) 6-Inch Through 24-Inch Pipe:
a) Mechanical joints with Megalugs by Ebaa Iron Sales; or equal.
b) Push-on joint with stainless steel gripper gasket.
c) Restrained joints, as indicated on Drawings, to match restrained joint pipe.
2) 30-Inch Through 48-Inch Pipe: Restrained joints.

c. Joint Restraint for Ductile Iron Fittings to PVC Pipe:
1) 4-Inch Through 12-Inch:
a) Series 1600HV by Ebaa Iron Sales.
b) Series 1350/1390 by Uni-flange Corporation.
c) Manufactured and marked for use on PVC.
2) 14-Inch Through 24-Inch pipe:
a) Series 2800 by Ebaa Iron Sales.
b) Series 1350/1390 by Uni-flange Corporation.
c) Manufactured and marked for use on PVC.

d. Electrical Continuity:
1) Wedges:
a) Serrated silicon bronze.
b) Two per joint.
2) External Conductor Connection:
a) U.S. Pipe: Electro-bond.
b) Erico: Cadweld.
c) Clow: Cable-bond.
d) American: Copper strip conductor.
e) Conduction cable or strap capable of carrying 600 amperes for an extended period without overheating.
f) Conductor permanently fastened to both sides of joint by shop or field weld.
g) Epoxy coat field installed jumper strip and connections with Kopper's 300M or equivalent.
3) Conductive Gaskets:
a) American: Fastite Conductive Gasket.
b) Gasket to provide enclosed and protected contact between pipe and fittings.
c) Factory applied protective coating on sockets and plain ends of pipe and fittings.

C. Gaskets:
1. ANSI/AWWA C111/A21.11.
2. Styrene Butadiene (SBR).

2.2 MANUFACTURED UNITS

A. Valves:
1. Manufacturer: EJIW, Clow, US Pipe.
2. Resilient-Seated Gate Valve: AWWA C515:
a. Nonrising stem.
b. Wrench nut, 2-inch square.
c. Open left (counter clockwise).
d. Mechanical joint ends.
e. Stem Seal: Buna-N double O-rings.
f. Body and Bonnet: Ductile iron.
g. Wedge: ASTM D429 rubber coated cast or ductile iron.
h. Coating: AWWA C550 fusion-bonded epoxy.
i. Pressure Rating: 200 psi.
j. Stem: Manganese bronze.

3. Air and Vacuum Valve:
   a. Valve shall be designed to release large quantities of air when the pump is turned on and shall close watertight when the pump liquid enters the valve. The valve shall also permit large quantities of air to enter when the pump is turned off.
   b. The body, cover and throttling device shall be cast iron ASTM A48 Class 30. The float shall be stainless steel ASTM A240. The seat shall be HY-CAR rubber or Buna-N.
   c. The discharge orifice shall be fitted with an adjustable throttling device to regulate the flow of air escaping to establish a pressure loading on the rising column of water to minimize shock to the pump and check valve upon closure of the air release valve.
   d. The valve shall be equal to Apco Model 142WD. Crispin Model DID.
4. Backflow Preventors:
   a. Reduced pressure principal backflow preventer.
   b. AWWA C511.
   c. Cla-Val Model RP-4; or equal.
   d. UL, FM approved.
   e. Maximum working pressure: 175 psi.
   f. Flanged ends, 125 pounds ANSI B16.1.
   g. Body: Cast iron ASTM A126.
   h. Epoxy coating interior and exterior.
   i. Stainless steel spring-loaded toggle lever check valve.
   j. In-line differential relief valve to maintain 2 psi (minimum) lower pressure between valves and inlet pressure.
   k. Two test cocks per valve.
   l. Installation must be tested and certified by licensed plumber.
5. Pressure Reducing Valve:
   a. Single-seated, hydraulically operated, pilot controlled, diaphragm type, globe valve.
   b. AWWA.
   c. OCV Model 127-3; or equal.
   d. Automatically reduces higher inlet pressure to constant lower downstream pressure, regardless of changing flow or varying inlet pressure.
   e. Operating Pressure: 75 to 150 psi.
   f. Cast Iron Body: ASTM A126.
6. Valve Boxes:
   a. Manufacturers and Models:
      1) East Jordan Iron Works 8560 with No. 6 base.
      2) Tyler Pipe, 6860 series with #6 base.
      3) Mueller 10357 with No. 160 base.
   b. 5-1/4-inch shaft.
   c. Three section cast iron.
   d. Cast iron lid marked "WATER".
   e. Adjustable:
      1) By means of threaded top and center sections.
      2) Height: 51 inches to 72 inches.
7. Post Indicators:
   a. Manufacturers and Models: Waterous A240; or equal.
   b. Cast iron post.
   c. Window with “OPEN” or “CLOSED” indicator.
   d. Cast iron wrench actuator.
   e. Depth of Bury: 6 feet.

B. Manholes, Vaults and Chambers:
1. General:
   a. Grade Rings: ASTM C478.
   b. Joints:
      1) 1-inch butyl gasket in flexible rope form.
      2) E.Z. Stik, Butyl-Lok; or equal.
   c. Steps:
      1) Manufacturers: MA Industries, PS-1-PF; or equal.
      2) Steel rod, 1/2-inch, encapsulated in copolymer polypropylene.

d. Casting:
1) Manufacturers and Models: Neenah, R-1670; East Jordan Iron Works, 1045.
2) Solid, gasketed, self-sealing cover.
3) Imprinted on Cover: "WATER".
e. Connection Between Manhole and Sewer:
1) Resilient Connector: ASTM C923 and ASTM A167.
2) 304 stainless steel bands.
3) KOR-N-SEAL by NPS, Inc.; or equal.
2. Valve Manholes and Air Release Chambers:
a. Precast Sections: ASTM C478.
b. Corporation Stops: Mueller, H-15000; Hays Co., 5200.
3. Valve Vaults:
a. Precast Sections: C 478.
b. Waterproofing Bituminous: ASTM D449.

2.3 WATER SERVICE MATERIALS

A. General:
1. General: AWWA C800.
2. Service Clamps:
a. Bronze, double strap, iron pipe thread, o-ring seal cemented in place.
b. Manufacturer: Mueller; Rockwell; or equal.
3. Corporation Stops:
a. Bronze, iron pipe thread by compression copper.
b. Manufacturers: Mueller; McDonald; Ford; Hays; or equal.
4. Curb Stops:
a. Bronze, compression copper by compression copper.
b. Minneapolis pattern.
c. Manufacturers: Mueller; Ford; McDonald; Hays; or equal.
5. Curb Boxes:
a. Minneapolis pattern, extension type.
b. Manufacturers: Mueller; McDonald; M&E Manufacturing; or equal.

B. Service Lines: Copper: B 88, Type K, soft-temper.

C. Water Service Meter Connections (Indoors):
1. Copper: ASTM B88, Type K, L, hard drawn.
2. Copper Horns: Ford No. 3 or 4, Copperhorn; or equal.
3. Valves:
a. Inlet Ball Valve:
1) Ford B11; or equal.
2) Bronze body, tee head, stem.
3) O-rings: Buna-N.
4) Valve Seats: Buna-N.
5) Ball: Fluorocarbon-coated brass.
4. Couplings and Fittings: Brass 85-5-5-5 (B 62), flared joints.

D. Residential Meter Pits:
1. Copper: ASTM B88 Type K, annealed and soft-temper.
2. Coppersetter: Ford Series 80; or equal.
3. Valves:
a. Inlet Ball Valve: Ford BA23; or equal:
1) Bronze body, tee head, stem.
2) O-Rings: Buna-N.
3) Valve Seat: Buna-N.
4) Ball: Fluorocarbon-coated brass.
5) Meter coupling nut.
4. Couplings and Fittings: Brass 85-5-5-5 (B 62).

5. Meter Box Cover:
   a. Ford Wabash W3, double lid; or equal.
   b. Body, Lid: Cast iron.
   c. Inner Lid: Plastic.
   d. 11-1/2-inch opening.
   e. 4 inches dead air space between covers.
   f. Top lid lockable with pentagon bolt.
6. Meter Pit:
   a. 20-inch diameter.
   b. PVC, D 1785, Schedule 40.

E. Displacement Type Water Meters:
1. AWWA C700.
2. Guarantee:
   a. AWWA New Meter Accuracy Standards for Minimum of:
      1) Five years, or
      2) 500,000 gallons (5/8-inch Meter), 750,000 gallons (3/4-inch Meter), 1,000,000 gallons (1-inch Meter).
3. Sensus Technologies, Inc., SR II; or equal.
4. Measuring Element: Oscillating piston.
5. Accuracy: 100% ± 1.5%.
6. Low Flow Registration: 95% at 1/2 gal./min.
7. Maximum Pressure Loss: 9.0 psi at 30 gal./min.
8. Size:
   a. 3/4-inch meter for 1-inch service line.
   b. 1-inch meter for 2-inch service line.
9. Register:
   a. Straight reading.
   b. Hermetically sealed.
   c. Magnetic drive.
   d. 6 odometer wheel display.
   e. 10 gallon increments.
   f. 360 degree test circle with center sweephand.
   g. Low floor detector.
   h. Tamper proof locking system.
10. Remote Readout:
   a. Sensus Technologies, Self-Generating Remote; or equal.
   b. Straight reading.
   c. Hermetically sealed.
   d. Magnetic drive.
   e. 5 odometer wheel display.
   f. 10 gallon increments.
   g. Tamper proof locking system.
11. Materials:
   a. Maincase: Bronze.
   b. Bottom Plate: Case iron.
   c. Measuring Chamber: Corrosion resistant thermoplastic.
   d. Magnets: Plasticized material.
   e. Casting Bolts: Stainless steel.
   f. Tamper proof locking system.

F. Compound water meter:
1. AWWA C702.
2. Guarantee: AWWA New Meter Accuracy Standards for a Minimum of:
   a. Five years, or
   b. 1,000,000 gallons.
3. Sensus Technologies, Inc., SRH Compound meter; or equal.
4. Measuring Element:
   a. Low Flow: Piston type positive displacement.
   b. High Flow: Turbine.
5. Bronze swing action diversion valve.

6. Single billing register.
7. Accuracy: 100% ± 1.5%.
8. Low flow registration: 95% at 1/4 gpm.
9. Maximum Pressure Loss: 5.1 psi at 160 gpm.
10. Size: 2-inch meter for 4-inch service line.
11. Register:
    a. Straight reading.
    b. 10,000,000 gallons, 100 gallon/sweep hand revolution.
    c. Hermetically sealed.
12. Remote Readout:
    a. Sensus Technologies, Inc., GTR remote.
    b. Straight reading.
    c. Hermetically sealed.
    d. Gallons.
13. Materials:
    a. Maincase: Bronze.
    b. Bypass Chamber: Bronze.
    c. Piston: Hard rubber.
    d. Turbine: Polypropylene.
    e. Valve: Bronze.
    f. Turbine Chamber: Synthetic polymer.
14. Strainer:
    a. Cast bronze body.
    b. Stainless steel screen.
    c. Flanged end connections.

2.4 MISCELLANEOUS

A. Tracer Wire:
1. 14 gage copper.
2. Brown or black insulation.
3. Splice Wrap: Scotch 2200, vinyl mastic pads.
4. Place on top of pipe.
5. Required with all plastic pipe.

B. Go - No Go Mandrell:
1. Manufacturer: Cherne Industries, Inc.; or equal.
2. Gage Outside Diameter: Not less than 95% of base inside pipe diameter.
3. Minimum 9 fins.
4. Length:
    a. 4-Inch through 15-Inch Fin Sets: 10-inch.
    b. 18-Inch through 48-Inch Fin Sets: 24-inch.
5. Required for all plastic pipe installations.

PART 3 - EXECUTION

3.1 EARTHWORK

A. In accordance with Division 31 Section “Excavation and Fill for Utilities.”

3.2 LINE AND GRADE

A. Lay pipe to the grades and elevations indicated on the Drawings.

B. Where No Grades are Indicated:
1. Lay pipe with a minimum of 5 feet of cover below finish grade.
2. Lay pipe at constant uphill and downhill grades to and from air release valves.
3. Avoid high points except at air release valves.

3.3 INSTALLATION

A. General:
1. Except as herein provided or indicated on the Drawings, install in accordance with:
   a. DI: AWWA C600.
   b. PVC: AWWA M23.
2. Protect all materials before, during and after installation.
3. Install pipe, fittings and appurtenances in accordance with Manufacturer's recommendations except as indicated herein or on the Drawings.
4. Prevent entrance of foreign materials.
5. Restrain pipe, fittings, valves and couplings as required.

B. Placement of Pipe:
1. Bearing: Support entire length of pipe barrel evenly with extra excavation at joints.
2. Bell and Spigot: Clean and lubricate immediately prior to assembly.
3. Jointing:
   a. Mechanical: Tighten evenly to 75 to 90-foot-pounds of torque.
   b. Restrained: Manufacturer's recommended method.
4. Cutting Pipe:
   a. Power saw.
   b. Ductile Iron and PVC Pipe: Taper cut end by grinding or filing back at least 1/8-inch on a 30 degree bevel.
5. Thoroughly clean gasket seating surfaces in the socket and on the plain end of the pipe to remove all coating rust and foreign material before use of conductive gasket.

C. Setting Valves and Valve Boxes:
1. Set plumb on 4 inches of compacted 3/8-inch (minimum) crushed stone.
2. Valve Boxes:
   a. Shall not transmit shock to valve.
   b. Plumb over operating nut.
   c. Set cover to finished grade.
   d. Witness.
3. Pressure Tap Sleeve and Valve:
   a. Set at the direction of tapping Subcontractor.
   b. Set and remove tapping machine.

D. Hydrants: Place “Out of Service” placards or labeled bags on pumper nozzle of all hydrants immediately after installation and on all disconnected existing hydrants. Remove after water main is placed in service.

E. Thrust Control:
1. Provide at all fittings.
2. Installation in Accordance With:
   a. Shop Drawings reviewed by Engineer.
   b. Manufacturer's instructions.
3. Restrain all pipe joints within given distance from each fitting (both directions):

Table 1
Length of Restrained Pipe Required

Pipe Diameter	22-1/2 Degree Bends and Less	45 Degree Bends	90 Degrees Bends, Plugs	Tee Run	Tee Branch
6-inch	5-foot	10-foot	20-foot	10-foot	10-foot
8-inch	5-foot	10-foot	25-foot	10-foot	20-foot
10-inch	5-foot	15-foot	35-foot	10-foot	25-foot
12-inch	10-foot	15-foot	40-foot	10-foot	30-foot
16-inch	10-foot	20-foot	50-foot	10-foot	40-foot

F. Service Leads:
1. Taps at 45 degrees above center.
2. Use double strap saddle for all taps on PVC pipe and for services on DIP over 1-1/2-inch.
3. Direct tap ductile iron pipe for 1/2-inch through 1-1/2-inch services only.

4. Alignment and Grade:
   a. At right angles with street line.
   b. Minimum depth: 5 feet of cover.

G. Placement of Tracer Wire or Pipe Identification Tape:
1. Bury 12 inches above water main.
2. Solder and wrap wire splices.
3. Splice pipe identification tape to ensure continuity of metal foil.
4. Bring wire or tape to surface in valve boxes or as directed by Engineer.

3.4 RESIDENTIAL WATER CONNECTION

A. Preparation:
1. Comply with local plumbing code.
2. Obtain plumbing permit for each residence and pay all fees.
3. Organize and coordinate a date and time with each residence to receive a new connection. A list of names, addresses, and telephone numbers will be made available to Contractor.
4. Review area where water main will enter house and connect to existing plumbing. Organize and coordinate the temporary removal of all false walls.

B. Basement Penetration:
1. Core drill 3-inch maximum hole for 1-inch or 1-1/2-inch copper service. Hole to be minimum of 5 feet below exterior finished grade.
2. If basement wall is nonexistent or cannot be drilled, the copper may be fed into the house through the basement floor with mole tunneling equipment.
3. Seal void between hole and copper with Fosrock, Preco Plug, or equal.
4. Existing service lines from wells may not be used for new connections, unless approved by Engineer.

C. Connection of New Service Line:
1. Connect new shut off valve, copper horn, and meter within 3 feet of basement wall.
2. Continue 1-inch copper to existing house plumbing. Connect to maximum pipe size of system. Provide all copper and fittings necessary to make connection.
3. Install remote meter reader in a visible location on the exterior of the home, in a location approved by homeowner.
4. Flush water system until water clears, check all new plumbing for leaks.
5. Restore temporary removals or damages to the lawn, driveway, or building.
6. Have homeowner sign a letter of acceptance of the Work, in a form approved by Engineer.

D. Remote Meters:
1. If building does not have a basement, or an area where meter can be installed inside of the first floor, utilize a meter pit.
2. Install meter pit on private property in a location approved by the homeowner.
3. Run new copper into the home and install a new shut off valve. Install new copper to the existing house plumbing.
4. Install remote meter reader on exterior of the home, in a location approved by homeowner.
5. Flush water system until water clears, check all new plumbing for leaks.
6. Restore temporary removals or damages to the lawn, driveway, or building.
7. Have homeowner sign a letter of acceptance of the Work, in a form approved by the Engineer.

E. Disconnection of Existing Well Service Line:
1. Saw cut existing supply line just inside basement wall and plug pipe with threaded or soldered cap.
2. Disconnect bladder tank from house plumbing. Saw cut pipe to tank and cap with threaded or soldered cap.

3.5 TESTING AND DISINFECTION

A. Observation: By Engineer.

B. Notification:
   1. Pressure Testing: Arrange with Engineer following successful pretesting.
   2. Bacteriological Testing: Arrange with Engineer following successful pressure test.

C. Equipment and Manpower: Provide everything required for testing, disinfection and flushing.

D. Water:
   1. To be provided by Owner.
   2. Provide temporary connections from Municipal water system to the water main or for hauling water.
   3. Provide backflow prevention device.

E. Pressure and Leak Tests for DI and PVC Pipe:
   1. ANSI/AWWA C600.
   2. Duration: 2 hours.
   3. Pressure:
      a. Maintain 150 pounds per square inch at the average elevation in water main segment being tested.
      b. Do not exceed the pipe's rated test pressure.
   4. Water:
      a. To be provided by Owner.
      b. Contractor shall be responsible for providing temporary connections and backflow preventor from Municipal water system for hauling water.
   5. Make-Up Water: From measurable source.
   6. Maximum Allowable Leakage:

$$L = \frac{SxDxP^{0.5}}{148{,}000} + 0.0078 \text{ gal/hr/in of diameter for each closed valve tested against}$$

      L = Leakage in gallons per hour.
      S = Length of pipe tested in feet; maximum value 2,000. When length of pipe tested exceeds 2,000 feet, the allowable leakage will be based on 2,000 feet.
      D = Pipe diameter in inches.
      P = Test pressure: 150 pounds per square inch.

   7. Maximum Length of Pipe to be Tested: 2,000 feet, or nearest 2 valves if water on opposite side of valve is not in service.
   8. Perform test against tapped cap or plug with a standpipe and not against existing valve if water on opposite side of valve is in service.
   9. Repair leaks and repeat tests until acceptable results are achieved.
   10. Pressure testing against existing valves not allowed.

F. Electrical Continuity:
   1. Test ductile iron pipe for continuity using pipe locating equipment by Metrotech or similar method.
   2. Repair breaks.

G. Disinfection:
   1. In Accordance with AWWA C651:
      a. Sodium hypochlorite.
      b. Continuous-feed method.
      c. Calcium hypochlorite granules not required.
      d. Minimum residual 25 parts per million (ppm) initial concentration.
      e. Minimum residual 10 ppm after 24 hours.

H. Flushing:
   1. Water main Mainlines: In accordance with AWWA C651.
   2. Water Services Into Buildings: In accordance with NFPA 24.
   3. Water: Owner supplied.
   4. Provide backflow preventor.

5. Velocity:
    a. Water main Mainline: Minimum 3 feet per second in accordance with AWWA.
    b. Water Services (Domestic and Fire Protection): Minimum 10 feet per second in accordance with NFPA.
6. Duration:
    a. Initial: Until entire volume of water in pipeline has been replaced.
    b. Final: Until residual chlorine equals that of adjoining system.
7. Dispose of chlorine residual in accordance with applicable state and local requirements.
8. Disposal location to be inspected by Engineer. If there is any questions that the discharge will harm the environment, apply a reducing agent to the water to neutralize the chlorine to a 1 ppm residual.

I. Bacteriological Testing:
1. In accordance with AWWA C651 and state regulatory agency requirements.
2. Two consecutive bacteriologically safe samples must be taken at 24-hour intervals for each section of pipe tested.
3. Repeat disinfection if bacteriological test fails.
4. Collect Samples from each branch of pipe, and at a maximum spacing of 1,000 feet.
5. Engineer: Transport Samples to lab for testing.
6. Cost of initial and repeat bacteriological lab tests are the responsibility of Contractor.

J. Sequence:
1. Pressure test.
2. Flush.
3. Chlorinate.
4. Flush.
5. Wait 24 hours.
6. Bacteriological sample.
7. Wait 24 hours.
8. Bacteriological sample.
9. Place in service.

END OF SECTION 33 10 00

SECTION 33 29 00 – WELL ABANDONMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the abandonment of the private water wells listed in Exhibit A.

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the Work of this Section shall comply with the following: Michigan Public Health Code, Act 368, P.A. of 1978, Part 127 - Ground Water Quality Control Act and Administrative Rules.

1.4 SUBMITTALS

A. Manufacturer's Literature: For Granular Bentonite:
   1. Name of Manufacturer.
   2. Size and composition of material.

B. Written Report:
   1. Within 30 days from project completion provide a written report on well abandonment. Specify for each well abandoned:
      a. Resident address.
      b. Type of well abandoned.
      c. Method of abandonment.
      d. Plugging material: Type and volume.
      e. Diameter and lineal feet of casing removed.

1.5 QUALITY ASSURANCE

A. Personnel Qualifications:
   1. Trained and experienced in the abandoning of wells.
   2. Licensed well driller registered in the State of Michigan.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate well abandonment with Engineer to ensure that property owner is receiving water from the public water supply system prior to commencing well abandonment.

PART 2 - PRODUCTS

2.1 PLUGGING MATERIALS

A. Bentonite:
1. Preformed pellets.
2. Sodium bentonite.
3. Minimum size 1/4-inch diameter.
4. Maximum size 3/4-inch diameter.

2.2 WATER

A. Obtain potable water from property owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. General:
1. Verify well has been disconnected from house plumbing.
2. Verify location of well to be abandoned.
3. Protect surrounding work area from damage.

3.2 CASING REMOVAL

A. Remove Well Screen and Casing Where:
1. Specified in Appendix, or
2. As specified herein.

B. Remove well screen and casing if well depth measurements and local geological information indicate that the existing contaminated well terminates in the same formation as the completed replacement well (if applicable), penetrates non-casing overburden (clay, hardpan) or has a visible open annular space around the casing.

C. Remove the casing by applying a lifting force to the casting with a drilling rig, jacks, jarring head, or trip casing spear.

D. In overburden, the plugging material shall be laced into the well after the screen is removed and prior to the removal of the casing so that the plugging material is in contact with the formation material as the casing is being pulled.

3.3 PLUGGING PROCEDURE

A. Preparation:
1. Remove all materials which may hinder proper abandonment including pumping equipment, drop pipe, packer jets and check valves.
2. Removal of bremer check valves not required.

B. Plugging:
1. Pour bentonite slowly into the well at an even rate, not to exceed 5 minutes per 50 pounds of material.
2. Measure height of accumulated material with a work pipe or weighted string to check for possible bridging after each 50 pounds of material is placed. If bridging has occurred, a work pipe, drill rod, or other device shall be run into the casing to break the bridging.
3. Fill casing to within 12 inches of finished grade.
4. Fill casing with water to promote expansion of bentonite.
5. Cut casing at 12 inches below grade.
6. Weld or thread steel cap to new top of casing, or pour 6-inch concrete cap over well to 6 inches below grade.

3.4 SALVAGE RIGHTS

A. All casing, drop pipe, packer jets, check valves, screens or other fittings removed from the well shall be the property of the property owner, unless property owner requests materials to be removed from Site.

3.5 SITE RENOVATION

A. Restore Site to original condition.

B. Regrade area to conform to existing ground contours.

C. Restore lawn in accordance with Division 32 Section “Turf and Grasses.”

D. Remove all well materials as directed by property owner.

E. Remove all plugging material from work area.

3.6 SCHEDULES

A. Exhibit A - Well Abandonment.

END OF SECTION 33 29 00

SECTION 40 05 13 – PROCESS PIPING SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of process piping.

B. Work included under this Section:
   1. Non-buried process piping indicated on the Process Drawings.
   2. Buried process piping to a distance of 10-15 feet from a building penetration.

C. Work not included under this Section:
   1. Piping indicated on plumbing and mechanical Drawings, including natural gas piping, building drain waste and vent systems, potable water plumbing systems, and piping systems to support HVAC systems.

D. Related Section includes Division 40 Section “Process Valves.”

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the work of this Section shall comply with the following:
   1. ANSI B 16.5 - Pipe Flanges and Flange Fittings.
   2. ASTM Standards:
      a. A36 - Structural Steel.
      b. A53 - Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
      c. A193 - Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
      d. A194 - Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
      e. A234 - Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
      f. A283 - Low and Intermediate Tensile Strength Carbon Steel Plates.
      g. A312 - Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
      h. A403 - Wrought Austenitic Stainless Steel Piping Fittings.
      i. D1784 - Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
      j. D1785 - Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
      k. D2464 - Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
      l. D2467 - Socket Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
      m. D2992 - Obtaining Hydrostatic Design Basis for Reinforced Thermosetting Resin Pipe and Fittings.
      n. D2996 - Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
      o. E8 - Low and Intermediate Tensile Strength Carbon Steel Plates.
      p. E23 - Notched Bar Impact Testing of Metallic Materials.
   3. AWWA Standards:
      a. C 104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fitting for Water.
      b. C 110 - Ductile-Iron and Gray-Iron Fittings, 3 In. through 48 In., for Water and Other Liquids.
      c. C 115 - Flanged Ductile-Iron Pipe with Threaded Flanges.
      d. C 151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
      e. C 200 - Steel Water Pipe 6 In. and Larger.
      f. C 207 - Steel Pipe Flanges for Waterworks Service - Sizes 4 In. through 144 In.
      g. C 208 - Dimensions for Fabricated Steel Water Pipe Fittings.
      h. C 210 - Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines

i. C 219 - Bolted Sleeve-Type Couplings for Plain-End Pipe.
j. C 220 - Stainless Steel Pipe, 4-Inch and Larger.
k. C 600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
l. C 606 - Grooved and Shouldered Joints.
m. C 651 - Disinfecting Water Mains.
n. Design Manual M-11 - Steel Pipe – A Guide for Design and Installation.

4. NSF Standards:
   a. 14 - Plastic Piping Components and Related Materials.
   b. 61 - Drinking Water System Components.

1.4 DESIGN AND PERFORMANCE REQUIREMENTS

A. Pipe:
1. Design, fabricate and install according to the references and standards specified herein.
2. The Drawings indicate general pipe layout only. Details of joints, couplings, tie rods, supports and make-up pieces are not necessarily indicated. Submit proposed details for these components for Engineer's review.
3. Provide makeup pipe spools, supports and suitable couplings so that piping may be easily separated for removing valves and inline flanged device.

B. Supports and Hangers:
1. The detailed design, layout and spacing of process pipe supports shall be the responsibility of the Contractor. The required locations of some supports may be indicated on the Drawings.
2. Design to prevent pipe sway and movement.
3. Adequate to prevent sagging of plastic pipe.
4. Utilize supporting members as indicated on the structural Drawings for the design, layout and spacing of the process piping supports systems.
5. Design process piping support systems to allow process valves and meters to be removed from the piping system without adding temporary pipe supports to the pipe upstream or downstream of the valve or meter.

1.5 SUBMITTALS

A. Itemized Listings:
1. Equipment to be provided.
2. Deviations from the requirements of this Section.

B. Shop Drawings: For equipment assemblies in this Section to include:
1. Details of construction and installation, including taps, weld-on outlets, water collars, specials, and similar features.
2. Pipe diameter, wall thickness, length, centerline elevations, and locations and dimensions of valves fittings, taps, and in-line equipment and instruments, and similar features.
3. Location and centerline elevation of wall sleeves and wall pipes.
4. Type and location of pipe supports on 8-inch pipe and larger.
5. Details for concrete pipe supports including dimensions, reinforcement, pipe straps and locations proposed for use.
6. Type and location of pipe couplings.
7. Schedule of wall sleeves and pipes indicating proposed sizes, lengths, and connection details.
8. Preliminary testing schedule showing pipe sections to be tested, bulkheads, drains, and chlorine injection locations.
9. Schedule of coatings.

C. Product/Catalogue Data: For all products in this Section to include:
1. Manufacturer.
2. Manufacturer's engineering and specification data.
3. Dimensions, thicknesses, cross-sections, materials of construction.
4. Coatings.

D. Installation Instructions:
   1. Submit complete Manufacturer's installation instructions for all products.
   2. Submit pipe Manufacturer's recommended span lengths between hangers or supports for each pipe size and type.

E. Certifications: Submit Manufacturer's certification that products and materials conform to these Specifications.

1.6 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in the fabrication and installation of the materials and equipment.
   2. Knowledgeable of the design and the reviewed Shop Drawings.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration, damage, contamination with foreign matter, and damage by weather or elements, and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General:
   1. In-Plant Process Piping 3-Inch and Larger:
      a. Ductile iron or carbon steel.
      b. Unless otherwise specified below or indicated on the Drawings.
   2. Provide taps at locations indicated on the Drawings.

B. Ductile Iron Pipe Systems:
   1. Ductile Iron Pipe: Conform to AWWA C 151, Class 53.
   2. Minimum Tests and Test Results of the Physical Characteristics of the Pipe:
      a. Tensile Test:
         1) ASTM E8.
         2) Minimum Tensile Strength: 60,000 psi.
         3) Minimum Yield Strength: 42,000 psi.
         4) Minimum Elongation: 10%.
      b. Notched Charpy Impact Test:
         1) ASTM E23 with 0.500-inch specimen.
         2) Minimum 7 ft-lbs at 70 degree F ± 10.
      c. Hydrostatic Pressure Test: Test pipe at 500 psi for at least a 10-second duration.
   3. Ductile Iron Pipe: Cement mortar lined according to AWWA C 104.
   4. Pipe Joints: Pressure rated at least as great as the pipe or fittings of which it is a part.
   5. Flanges:
      a. Conform to AWWA C 115.
      b. Flange bolts and Hardware: Galvanized or zinc-plated.
   6. Flange Gaskets: Full face, rubber, NSF listed for potable water service.
   7. Fittings: Conform to AWWA C 110 with cement mortar lining as specified above.
   8. Grooved Pipe Joints and Couplings:
      a. For Pump Connections and Flexible Joints: Victaulic Style 31.
      b. Ductile iron body, galvanized or zinc-plated hardware.
      c. Gasket NSF listed for potable water service.
      d. Conform to AWWA C 606.
      e. Flexible joint grooving.

9. Provide factory fabricated weld-on outlets meeting AWWA C111 and C115 where indicated on Drawings. Coat and line piping after welding.
10. Paint outside of pipe, fittings, flanges and couplings in accordance with Division 09 Section “Painting.”

C. Copper Pipe Systems:
1. Use: Miscellaneous small water piping, including sample piping, air valve discharges, instrument connections.
2. Material:
   a. 1/2-inch and Larger:
      1) Seamless copper tubing.
      2) ASTM B88, Type L, hard drawn.
   b. 3/8-inch O.D. and Smaller:
      1) Seamless copper tubing.
      2) ASTM B88, Type K, soft temper.
3. Factory coded and marked. Piping 2 feet and longer shall have a permanent marking in accordance with ASTM or ANSI specifications.
4. Soft temper tubing shall have long radius bends preventing kinks.
5. Solder: 95% tin and 5% silver.
6. Fittings:
   a. Sweat type, wrought copper.
   b. Elbows shall be long radius type.
   c. Cast fittings will only be allowed by written approval from Engineer.
7. Provide threaded connections to valves and equipment.
8. Provide threaded unions between isolation valves and equipment for removal of equipment.

2.2 SUPPORTS AND HANGERS

A. General:
1. Design Layout and Spacing of the Pipe Supports: Responsibility of Contractor.
2. Furnish factory fabricated hangers and supports complete with necessary inserts, clamps, bolts, nuts, washers, and accessories.
3. On pipes 12-inch diameter and larger, generally use pipe stand type supports extending to the floor below. Coordinate proposed use of hangers from floors above the pipe with Engineer to ensure that the floors are capable of supporting pipe weight.

B. Manufacturers and Types:
1. Pipe Hangers: Clevis or split ring type with adjustable threaded hanger rods.
2. Hangers and Supports: Grinnell, Unistrut, Crane; or equal.

C. Materials (Supports and Hardware);
1. Chemical Feed Rooms In and Above Process Tanks: Type 316L stainless steel.
2. General Process Service: Hot-dip galvanized or zinc-plated.
3. Isolate dissimilar pipe and support materials with 1/8-inch thick EPDM rubber sheet stock.

2.3 PIPE JOINT HARNESSES

A. Tie Rod Bolt: Conform to ASTM A193, Grade B7.

B. Tie Rod Lugs: Conform to ASTM A283, Grade C or ASTM A36.

C. Tie Rod Nuts: Conform to ASTM A194, Grade 2H.

2.4 RESTRAINED FLANGE ADAPTER

A. Provide restrained flange adapters for well pumps LW1 and PW2:
1. Manufacturer and type: EBAA Iron, Series 2100 Megaflange; or equal

2.5 PRESSURE GAGES

A. Provide pressure gages for each raw water pump discharge, high service pump suction and discharge, and each backwash wastewater pump discharge.

B. Gages shall be liquid filled and 4-1/2-inch diameter.

C. Pressure Range:
   1. Well Pump Discharge: 0 to 150 psig.

D. Manufacturer: Ashcroft, Model 1279 ; or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:
   1. Install process piping and accessories in conformance with:
      a. The Manufacturer's recommendations.
      b. The Shop Drawings as reviewed by Engineer.
   2. Install items to be embedded before concrete is placed.
   3. Fasten embedded items securely to prevent movement when concrete is placed.
   4. Install items plumb, square, true to lines, grades, elevations, and locations as indicated on the Drawings and herein specified.
   5. Do not install chemical piping within finished rooms, regardless of size.
   6. Valves, regardless of size and contents, shall be readily accessible. Chemical feed piping valves shall be accessible from operating floor.
   7. Do not install chemical feed piping over equipment.

B. Hangers and Supports:
   1. Install hangers and supports at less than maximum spacing as recommended by pipe Manufacturer.
   2. Adjust hangers and supports to bring pipe lines to proper elevations.
   3. Install inserts in concrete flush with the surface and capable of developing the full strength of the bolt.

C. PVC Piping: Installation procedures, including support spacing, solvent welding and allowance for expansion and contraction shall be in accordance with the Manufacturer's recommendations.

D. LDPE Tubing: Bending radius of tube shall be no smaller than 10 times the diameter.

E. Stainless Steel Piping: Tools used for cleaning welds on stainless steel pipe shall be designated for and be suitable for use with stainless steel, and shall not leave carbon residue in the welds.

3.2 PAINTING

A. Paint pipe, fittings, supports, hangers, sleeves and accessories in accordance with Division 09 Section “Painting.”

3.3 TESTING

A. General:
   1. Hydrostatically test the following process pressure piping lines:
      a. Pump Discharge.
   2. Tests shall be witnessed by Engineer.
   3. Provide necessary equipment to perform tests including, but not necessarily limited to pumps, plugs, hoses and gages.

B. Procedure:
   1. Pressure test procedure shall be in conformance with AWWA C 600, Section 4.
   2. Duration: 2 hours.
   3. Pressure: Maintain 150 pounds per square inch.
   4. No visible leaks.

C. Repairs: In case of leakage under test, locate and repair leaks in an approved manner and test section again until a satisfactory test is secured.

3.4 DISINFECTION

A. Disinfect new process piping in conformance with AWWA C 651.

B. After disinfection, flush new process piping until the chlorine residual in the new section of piping is equal to that of the adjoining system, or less than 2 mg/l.

C. Use adequate quantities of flushing water so that the chlorine residual of the combined flushing and disinfection water is similar to the water of the adjoining system and is suitable for disposal.

3.5 CLEANING

A. Thoroughly clean installed materials and Products and related areas:
   1. Prior to acceptance of the work of this Section.
   2. In accordance with Division 01 Section “Cleaning and Waste Management.”

3.6 PROCESS PIPING SCHEDULE

Description	Size	Material	Lining	Joint Style	Notes
Well Discharge	8-inch and 10-inch	DI	Cement mortar	Flanged and grooved	
Blow Off	6-inch	DI	Cement mortar	Flanged	

END OF SECTION 40 05 13

SECTION 40 05 23 – PROCESS VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes the furnishing and installation of all valves and valve operators in the process piping system as indicated on the process Drawings and defined in Division 40 Section “Process Piping Systems.”

B. This Section does not include the valves and operators for the piping systems indicated on the plumbing and mechanical Drawings.

C. Related Section includes Division 40 Section “Process Piping Systems.”

1.3 REFERENCES

A. Except as herein specified or as indicated on the Drawings, the valves and operators of this Section shall comply with the following as applicable:
   1. ASTM Specification:
      a. A48 - Gray Iron Castings.
      b. A126 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
      c. A148 - Aluminum Bronze Castings.
      d. A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware
      e. A240 - Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
      f. A351 - Steel Castings, Austenitic, for High Temperature.
      g. A436 - Austenitic Gray Iron Castings.
      h. A536 - Ductile Iron Castings.
      i. B21 - Naval Brass Rod, Bar, and Shapes.
   2. AWWA Standards:
      a. C 111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron.
      b. C 500 - Metal-Seated Gate Valves for Water Supply Service.
      c. C 504 - Rubber-Seated Butterfly Valves.
      d. C 507 - Ball Valves 6 In. Through 60 In.
      e. C 508 - Swing Check Valves for Waterworks Service. 2 In. Through 24 In.
      f. C 509 - Resilient-Seated Gate Valves for Water Supply Service.
      g. C 511 - Reduced Pressure Principle Backflow Prevention Assembly.
      h. C 512 - Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
      i. C 517 - Resilient-Seater Cast-iron Eccentric Plug Valves.
      j. C 520 - Knife Gate Valves, Sizes 2 In. Through 96 In.
      k. C 550 - Protective Epoxy Interior Coatings for Valves and Hydrants.
   3. NSF/ANSI Standards:
      a. 14 – Plastic Piping System Components and Related Materials.
      b. 61 – Drinking Water System Components - Health Effects.

1.4 SUBMITTALS

A. Shop Drawings:
   1. For equipment assemblies in this Section to include:
      a. Manufacturer.
      b. Model.
      c. Details of construction.
      d. Dimensions, including actuator dimensions and clearances.
      e. Materials of construction.

f. Listing of components.
g. Project specific wiring diagrams.
h. Coatings.
i. Weight of assemblies.

2. For each type of equipment installed to include:
   a. Itemized listings.
   b. Deviations from the requirements of this Section.

B. Product Data: For equipment in this Section to include:
1. Manufacturer.
2. Model.
3. Materials of construction.
4. Manufacturer’s engineering and specification data.
5. Electrical specifications and requirements.
6. Torque specifications for actuators.

C. Torque calculations for actuators.

D. Installation instructions for equipment in this Section.

E. Operation and Maintenance Manuals: For equipment in this Section to include:
1. Copy of reviewed Shop drawings and product/catalog data.
2. Equipment function, normal operating characteristics and limiting conditions.
3. Assembly, installation, alignment, adjustment and checking instructions.
4. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
5. Lubrication and maintenance instructions.
6. Guide to “troubleshooting.”
7. Parts lists and predicted life of parts subject to wear.
8. Outline, cross-sections, assembly drawings, engineering data, and wiring diagrams.

F. Certifications/Affidavits:
1. Submit Manufacturer’s certification that products and materials conform to these specifications.
2. Submit an affidavit from the valve manufacturer which certifies that actuators used were furnished and installed by the valve manufacturer.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
1. Trained and experienced in the fabrication and installation of the materials and equipment.
2. Knowledgeable of the design and the reviewed Submittals.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, and damage by weather or elements and in accordance with Manufacturer's directions.

C. Reject damaged, deteriorated or contaminated material and immediately remove from the Site. Replace rejected materials with new materials at no additional cost to Owner.

D. Ship and handle valves in conformance with Section 18 of AWWA C 504.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND TYPES

A. Provide valves of the size and type as indicated on the Drawings and these Specifications.

B. All valves of each type shall be the Product of one Manufacturer.

2.2 MATERIALS AND FABRICATION

A. Gate Valves (GV), 3 Inches in Diameter and Larger:
1. Conform with the latest edition of AWWA C 509 - Resilient-Seated Gate Valves for Water Supply Service.
2. Opening Direction: Counterclockwise as viewed from the top.
3. Stem Seal: V-type packing, O-ring seals or pull-down packing.
4. Manually operated geared actuators: nonrising stem.
5. All components within process tanks suitable for submerged service in chlorinated water.
6. Test Pressure: 250 psig minimum.
7. Coating:
   a. Interior surfaces and exterior immersed surfaces: Coat in accordance with AWWA C 550 using an ANSI/NSF Standard 61 - Potable Water (NSF-pw) listed epoxy; Tnemec; or equal.
   b. Exterior Surfaces (non-immersed): Shop prime coat in accordance with Division 09 Section “Painting” for exterior ferrous metals - nonimmersed (epoxy system).
8. Manufacturers:
   a. Clow Valve Company.
   b. Kennedy Valve.
   c. M & H Valve Company.
   d. Mueller Company.

B. Swing Check Valves:
1. Conform with the latest edition of AWWA C 508 - Swing Check Valves for Waterworks Service.
2. shall be of the full flow body type, with a domed access cover and only two moving parts, the flexible disc and the Disc Accelerator
3. NSF/ANSI 61 Drinking Water System Components – Health Effects, and certified to be Lead-Free in accordance with NSF/ANSI 372.
4. Flanges with drilling to ANSI B16.1, Class 125.
5. The valve body shall be full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45 degree angle to minimize disc travel.
6. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator or oil cushion device without special tools or removing the valve from the line.
7. The top access port shall be full size, allowing removal of the disc without removing the valve from the line.
8. The disc shall be of one-piece construction, precision molded with an integral O-ring type sealing surface and reinforced with alloy steel.
9. Non-Slam closing characteristics shall be provided through a short 35 degree disc stroke and a disc accelerator.
10. The valve disc shall be cycle tested 1,000,000 times in accordance with ANSI/AWWA C508.
11. Materials
   a. Valve body and cover shall be constructed of ASTM A536 ductile iron
   b. Disc shall be precision molded Buna-N (NBR)
   c. Disc accelerator Type 302 stainless steel
12. Coating:
   a. Interior surfaces and exterior immersed surfaces: Coat in accordance with AWWA C 550 using an NSF/ANSI Standard 61 - Potable Water (NSF-pw) listed epoxy; Tnemec; or equal.
   b. Exterior surfaces (non-immersed): Shop prime coat in accordance with Division 09 Section “Painting” for interior ferrous metals – non-immersed (epoxy system).
13. Manufacturers:
   a. Val-matic model VMC-7202.
   b. Or equal.

C. Air/Vacuum Valves:
1. Air Valves shall be fully automatic float operated valves designed to exhaust air which is present in the pump column on pump startup and allow air to re-enter the column on pump shutdown or should a negative pressure occur.
2. Conform to AWWA Standard C512: Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

3. Size: 2-inch.
4. Materials of Construction:
   a. Body: Ductile Iron.
   b. Float: Stainless steel.
   c. Seat: Buna-N.
   d. Bronze or stainless steel diffuser.
5. Inlet Connection: threaded.
6. Outlet Connection: threaded.
7. Operating Pressure: 250 psig or less.
8. Float: Capable of withstanding 250 psig
9. Accessories:
   a. Adjustable throttling device on outlet of valve. Allows for throttling air release and full unrestricted vacuum protection.
   b. Install gooseneck and direct exhaust pipe to floor drain.
10. Coating:
    a. Interior Surfaces: Coat in accordance with AWWA C550 using an ANSI/NSF Standard 61 - potable
    b. water (NSF-pw) listed epoxy; Tnemec; or approved equal.
    c. Exterior Surfaces (non-immersed): Shop prime coat in accordance with Division 09 Section "Painting" for interior ferrous metals – non-immersed (epoxy system).
11. Provide 1/4-inch mesh screen over discharge.
12. Manufacturer:
    a. APCO.
    b. Val-Matic (well service air valve)
    c. Crispin.
    d. Or equal.

D. Miscellaneous Ball Valves (use for drains, gage cocks, compressed air, instrument isolation, etc.):
   1. Brass body, stainless steel trim and locking lever handle.
   2. TFE seats/seals.
   3. Working Pressure: 250 psig at 100 degrees F.
   4. Neles - Jamesbury Fig. 351; Apollo; or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in conformance with:
   1. The Shop Drawings reviewed by Engineer.
   2. The Manufacturer's recommendations.

B. Check and adjust valves, operators, and accessories for smooth operation.

C. Paint all valves and accessories in accordance with Division 09 Section "Painting."

D. Labeling: Provide an engraved stainless steel tag securely fastened to each valve with the valve size, pressure rating, and tag number clearly indicated.

E. Pipe air valve discharges to drain with an air gap.

3.2 CLEANING

A. Thoroughly clean all installed materials and products and related areas:
   1. Prior to acceptance of the work of this Section.
   2. In accordance with Division 01 Section "Cleaning and Waste Management."

END OF SECTION 40 05 23

SECTION 40 90 00 – INSTRUMENTATION FOR PROCESS SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes, but is not necessarily limited to, the furnishing and installation of the process control and instrumentation system comprised of the major items listed below, as indicated on the Drawings, as specified herein, and as necessary for the proper and complete performance of the Work:
   1. Field instruments.

1.3 GENERAL REQUIREMENTS

A. Provide components which are compatible with process equipment.

B. Functionally similar components shall be products of a single Manufacturer.

C. Installation of new systems and equipment shall be sequenced and coordinated to minimize disruptions to Owner's normal operations.

D. Existing systems and equipment shall be kept in operation until new systems and equipment are functional and demonstrated to be reliable, to satisfaction of Engineer, for a minimum of 2 weeks.

1.4 SUBMITTALS

A. Itemized Listings:
   1. Description of deviations from the requirements of this Section.
   2. Re-submittals shall contain response(s) to each comment made by Engineer. Re-submittals that do not contain response(s) will be returned and will be subject to re-review compensation.

B. Shop Drawings:
   1. Shop Drawing submittal schedule listing Shop Drawings to be submitted with estimated time frame of submittal relative to other project milestones (e.g. programming development, factory test, performance demonstration, project closeout).
   2. General: Shop Drawing submittal material shall be project specific.
   3. For all process control and instrumentation equipment, to include:
      a. Manufacturer's name and model number.
      b. Equipment descriptions.
      c. Product data sheet(s).
      d. Standard drawings and illustrations.
      e. Dimensions.
      f. Materials of construction.
      g. Details of construction and installation.
      h. Detailed system schematic.
      i. Project specific wiring diagrams, clearly indicating all field wiring requirements.
      j. Spare parts list.

C. Operation and Maintenance Manuals:
   1. General:
      a. Table of contents.
      b. Subdivided (tabbed) into separate sections that cover separate equipment or grouping of equipment.
      c. Each site shall be uniquely tabbed. Manuals for each site shall be repeated as required so that remote site material can be separated and stand alone.

d. Provide 1 electronic copy (CD-ROM) per hard copy, of the overall O&M Manual that includes information for all sites. Owner shall be permitted to make copies of CD-ROM without restriction.

2. For all process control equipment, to include:
   a. Equipment function, normal operating characteristics and limiting conditions.
   b. Assembly, installation, alignment, adjustment and checking instructions.
   c. Operating instructions for start-up, routine and normal operating, regulation and control, and shutdown and emergency conditions.
   d. Lubrication and maintenance instructions.
   e. Guide to “troubleshooting.”
   f. Parts lists and predicated life of parts subject to maintenance replacement.
   g. Outline, cross-sections, assembly drawings, engineering data and wiring diagrams.
   h. Test data and performance curves.

1.5 QUALITY ASSURANCE

A. Fabrication and Installation Personnel Qualifications:
   1. Trained and experienced in fabrication and installation of materials and equipment.
   2. Knowledgeable of the design and reviewed Shop Drawings.

B. Manufacturer’s Services:
   1. Submit Manufacturer’s sworn statement that equipment furnished complies with this Specification and Manufacturer’s engineer’s written approval of installation.
   2. Provide Manufacturer’s field service as specified herein.

C. All materials, installation and testing shall be in accordance with ISA Standards and Recommended Practice.

D. Contractor shall conduct field investigations as required to verify existing conditions, I/O, programming, wiring requirements, instrument ranges/calibration and signal types.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver all materials in original, unbroken, brand marked containers or wrapping as applicable.

B. Handle and store materials in a manner which will prevent deterioration or damage, contamination with foreign matter, damage by weather or elements, and in accordance with Manufacturer’s directions.

C. Store materials indoors in a controlled environment with low moisture content. Do not store outdoors.

D. Reject damaged, deteriorated, or contaminated materials and immediately remove from Site. Replace rejected materials with new materials at no additional cost to Owner.

1.7 GUARANTEE AND WARRANTY

A. Process control and instrumentation system Supplier shall guarantee the entire system for a period of 1 year. This guarantee shall cover all parts, labor, troubleshooting, telephone consulting, travel, and equipment recalibration.

B. The 1-year guarantee period shall begin at Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Acceptable Manufacturers for major system components are specified herein.

B. Not all components are specified. It is the system Supplier’s responsibility to furnish and install components necessary to achieve the functional intent and to meet or exceed the governing local, state or national standards and/or codes.

C. Coordination of all field mounted instrumentation device installation shall be system Supplier's responsibility:
   1. Mounting of each device shall be designed with consideration to:
      a. Manufacturer's installation recommendations.
      b. Ease of removal for maintenance.
      c. Safety.
   2. Provide all mounting hardware required.
   3. All mounting hardware shall be of the following corrosion resistant material. Coordinate mounting material with surrounding environment:
      a. PVC.
      b. Stainless steel.
      c. FRP.
   4. Provide sufficient length of sensor to transmitter cable for each field device.
   5. Provide unions, bulkhead fittings, isolation valves, etc.

2.2 FIELD INSTRUMENTS

A. General:
   1. Schedules are provided as an aid to Contractor. It is Contractor's responsibility to verify information contained in the schedules for completeness and to provide equipment that is indicated elsewhere in Drawings and Specifications, but not listed in schedules.
   2. Provide instruments rated for environment.
   3. Field verify Manufacturer's cable lengths prior to Shop Drawing submittal.
   4. Existing instruments that are relocated or modified shall be recalibrated.
   5. Existing instruments with unknown scaling or ranges shall be recalibrated.
   6. Existing instruments that do not agree with new instrumentation shall be recalibrated.
   7. Existing instruments that are used in conjunction with new control systems shall be recalibrated.
   8. Tagging: Equip all instruments with a permanently attached, stamped or engraved identification tag. The tags shall include the device name, Engineer's tag identification, and manufacturer's tag identification if different from Engineer's.
   9. Finish: Finish on the instruments and accessories shall provide protection against corrosion by the elements in the environment in which they are to be installed.
   10. Temperature Rating: Instruments shall be suitable for the temperature in which they are to be exposed. Therefore, instruments located outdoors or in unheated spaces shall be suitable for -20 degrees F to 120 degrees F. Instruments exposed to direct sunlight (without sunshield) shall be suitable for temperatures up to 140 degrees F.
   11. Provide configuration software and cables or hand held device(s) for any instrument which cannot be fully programmed via keypad/interface which is integral to device.

B. Instrument Pipe Stand:
   1. General: Modular support system for mounting of instrumentation components.
   2. Provide for each instrument that cannot be wall mounted.
   3. Material of construction: Galvanized carbon steel, aluminum or stainless steel as required by environment to prevent corrosion.
   4. Floor stands shall have gussets for strength and stability.
   5. Size as required to mount instrument at 4′-6″ above operating level, unless otherwise noted.
   6. Manufacturers:
      a. O'Brien, Saddlepak.
      b. Techline Mfg.
      c. Or equal.

C. Continuous Pressure Measurement:
   1. Well Pump Discharge Pressure Monitoring:
      a. Pressure Transmitters PIT for Well House LW1 and PW2.
   2. Gage Pressure Transmitter:
      a. Microprocessor based smart transmitter.
      b. Display: Integral LCD.
      c. Material:
         1) Stainless steel wetted parts and diaphragm.
         2) Teflon O-rings.
         3) Silicone fill fluid.

4) Stainless steel mounting bracket and hardware.
5) Epoxy covered aluminum housing.

d. Accuracy: 0.075% of span with 5-year stability.
e. Rangeability: 30:1
f. Process Connection: ½-inch NPT.
g. Output: 4-20 mAdc plus HART protocol.
h. Power: Loop powered.
i. Schedule:
1) PIT-101 LW1 Discharge Pressure 0-150 psig
2) PIT-201 PW2 Discharge Pressure 0-150 psig
j. Manufacturers:
1) Rosemount
2) ABB
3) Honeywell
4) Endress & Hauser
5) Siemens
k. Accessories:
1) 316 stainless steel, two valve block and bleed manifold.
2) Provide 316 stainless steel mounting hardware.

D. Continuous Flow Measurement:
1. Well Pump Discharge Monitoring:
a. Flow meters with integral transmitter FE/FIT for Well House LW1 and PW2.
2. Magnetic Flow Meters:
a. Accuracy: Within ±0.25% of meter scale for a velocity of 1 to 33 fps and the repeatability shall be within ±0.1% of full scale.
b. Complete with grounding rings. Grounding probes are not acceptable.
c. Provide a standard 3-point calibration report traceable to a recognized standard.
d. All flow meters shall be of the same model/series.
e. NSF-61 certified meters suitable for use with potable water.
f. Meter Tube:
1) 304 stainless steel flow tube.
2) Meter shall maintain ISO 13359 standard lay lengths.
3) Liner:
a) Teflon, PFA, or Tefzel for 10-inch or smaller.
b) Polyurethane for 12-inch or greater.
c) It is the Supplier's responsibility to provide liner that is chemically compatible with the process fluid being measured.
d) Liners utilized in drinking water applications shall be NSF-61 certified.
4) Electrodes:
a) Bullet nose type.
b) Hasteloy C.
c) Titanium for Alum and Sodium Hypochlorite.
d) Platinum for Hydrofluosilicic Acid.
e) It is the Supplier's responsibility to provide electrodes that are chemically compatible with the process fluid being measured.
5) Grounding Rings:
a) 316 Stainless Steel for 12-inch or smaller.
b) 304 Stainless Steel for 14-inch or greater.
c) Titanium for Alum and Sodium Hypochlorite.
d) Hasteloy C for Hydrofluosilicic Acid.
e) It is the Supplier's responsibility to provide grounding rings that are chemically compatible with the process fluid being measured.
6) Flanges:
a) ANSI 150-pound, raised or flat for 1-inch to 24-inch.
b) Wafer style to be mounted between 2 ANSI 150-pound flanges for smaller than 1-inch
c) AWWA Class D flanges for meters larger than 24 inches.
d) Meter shall be fully rated to withstand the same design pressure as the flanges.
7) Epoxy or Powder Coated: 2 coats for a minimum of 7 mils.

8) Meters above grade and smaller than 12 inches shall be capable of accidental submergence. Meters 14 inches and larger or meters installed in a meter vault shall be capable of continuous submergence or direct burial (IP68/NEMA 6P).

g. Integral Transmitter:
1) One for each flow tube.
2) Solid state type.
3) Housing: Die-cast aluminum.
4) Integral to meter tube.
5) HART protocol.
6) Provide universal HART communicator/configurator which supports all HART devices.
7) Display:
a) Flow rate and totalized flow displayed on a backlit display.
b) Integral transmitter display shall be able to rotated 90 or 180 degrees to accommodate meter mounting position/orientation.
8) Transmitter shall include nonvolatile memory so that flow totalization is not lost during power interruptions. Provide totalizers for forward, reverse and net flow.
9) Output:
a) 4-20 mAdc into 0 to 800 ohms, proportional and calibrated to stated flow range.
b) HART.
c) Pulse output to be used for flow totalization. Configurable from 0 to 1000 pulses per second or pulses per unit volume. Pulse width shall be adjustable from 0.5 to 100 ms.
10) Provide empty pipe detection as standard.
11) Power: 120Vac, 60 HZ.
12) Enclosure: NEMA 4X.
13) Provide required lengths of Manufacturer's cable for remote mounted indicators.

h. Manufacturer:
1) ABB.
2) Rosemount.
3) Yokogawa.
4) Krohne.
5) Toshiba.
6) Endress + Hauser.

E. Submersible Level (Pressure) Sensor and Transmitter:
1. Well water level monitoring LE/LIT for Well House LW1 and PW2.
2. Level Sensor:
a. 316 stainless steel housing.
b. Ceramic sensor.
c. Maximum diameter of 0.87 inches
d. Accuracy: Within ±0.25% of full scale.
e. Provide signal cable in length as required.
f. Output: 4-20 mAdc proportional to level, wired to transmitter.
g. Power: 10 to 30 Vdc from transmitter (loop powered).
h. NSF-61 approved.
i. Sensor shall be capable of measuring maximum water level in Well within which it is installed.
j. Signal cable shall be designed to allow removal of the sensor from the Well without failure.
3. Transmitter:
a. NEMA 4X weatherproof housing.
b. UL listed.
c. Output: 4-20 mA proportional to level.
d. Power: 120 VAC from UPS.
4. Manufacturer and Model:
a. Endress+Hauser Waterpilot, Model FMX21 with Model RIA46 Field Meter.
b. Or equal.

F. Conductivity Level Switch:
   1. Conductivity level switch for Well House LW1 and PW2.
      a. Probe Holder/Connector Housing:
         1) Process Connection: 1 1/2-inch NPT.
         2) Enclosure: NEMA 4 Aluminum with 1/2-inch NPT conduit entry.
         3) Stainless steel fitting.
      b. Electrode:
         1) Stainless steel.
         2) Number of electrodes:
            a) 1 per level switch.
            b) Provide reference sensor for non-metallic tank installations.
         3) Full electrode cladding, compatible with process fluid.
      c. Electrode Relay:
         1) Number of Channels: 1 per level switch.
         2) Sensitivity: Adjustable.
         3) Mounting: DIN Rail.
         4) Power: 120 VAC.
         5) Output: SPDT, 4 Amp rated.
      d. Manufacturer:
         1) Endress + Hauser, Liquipoint T.
         2) Kobold, Model NE.
         3) Or equal.
      e. Accessories: Corrosion resistant hardware and mounting accessories.

G. Combination Temperature and Relative Humidity Transmitter:
   1. Temperature Range: -40 to 140 degrees F.
   2. Temperature Accuracy: ±0.9 degrees F at 72 degrees F.
   3. Relative Humidity Range: 0 to 100%.
   4. Relative Humidity Accuracy: ±3% at 20 to 80% RH; ±4% at 10 to 20% and 80 to 90% RH.
   5. Relative Humidity Hysteresis: ±1%.
   6. Relative Humidity Repeatability: ±0.1% typical.
   7. Output Signals: 4-20mA, loop powered.
   8. Response Time: 15 seconds.
   9. Electrical Connections: Removable screw terminal block.
   10. Relative Humidity Sensor: Capacitance polymer protected by a removable sintered filter.
   11. Temperature Sensor: Solid state band gap.
   12. Enclosure: ABS, NEMA 3S.
   13. Schedule:
      a. TT-101 & TT-201: -40 to 140 degrees F (relative humidity not used).
   14. Manufacturer:
      a. Dwyer WHT-311.
      b. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION COORDINATION

A. Install process control equipment and instrumentation in conformance with:
   1. Shop Drawings reviewed by Engineer.
   2. Manufacturer's recommendation.

B. Electrical:
   1. Install wiring in conformance with applicable Sections of Division 26 – Electrical.
   2. Run all 4-20 mAdc process control wiring in separate conduit from power and control wiring.
   3. Communication cabling shall be in separate conduits from power control and analog signal wiring.

C. Mount Control Panels:
   1. Securely with framing and fasteners capable of handling additional future loads.
   2. In a way that does not restrict access to internal components.

3.2 FIELD QUALITY CONTROL

A. System Supplier's Field Service:
   1. Schedule field services as soon as practical and at times approved by Engineer.
   2. Promptly make all changes and additions required by system Supplier's engineer and as necessary for proper operation of the system.
   3. System Supplier's engineer shall submit written approval of installation.

B. Field Performance Demonstration:
   1. Instruments:
      a. Demonstrate proper calibration and maximum accuracy.
      b. Demonstrate that system performs monitoring functions as specified and indicated on the Drawings.

END OF SECTION 40 90 00