CONTRACT DOCUMENTS

FOR

Palmer 3A and Juniper Well House Designs

DWSRF Project #7491-01

OHM Project No. 0020-22-0070 & No. 0020-22-0080

CITY OF OWOSSO
301 W. MAIN STREET
OWOSSO, MICHIGAN 48867

Issued for Bid
December 1, 2022

OHM Advancing Communities

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TECHNICAL SPECIFICATIONS

NOTICE TO BIDDERS

PALMER 3A AND JUNIPER WELL HOUSE DESIGNS
FOR THE CITY OF OWOSSO, MICHIGAN

Sealed proposals will be received by the City of Owosso for the **Palmer 3A and Juniper Well House Designs** and should be addressed to: **Bid Coordinator, City of Owosso, 301 W. Main Street, Owosso, Michigan 48867**.

The project at the Palmer site consists of demolition of the existing Palmer 3 wellhouse, abandonment of Palmer 3 well, abandonment of 150 feet of water main; installation of one wellhouse, one vertical line-shaft turbine pump and 71 feet of water main, installation of a gas-powered generator and two automatic transfer switches.

The project at the Juniper site consists of installation of one wellhouse, one vertical line-shaft turbine pump and 1,544 feet of water main: 1,460 feet of 12-inch water main directionally drilled and 84 feet of 12-inch water main open cut. Installation of a gas-powered generator.

The project will be financed through the State Revolving Loan Program and requirements for that program will be enforced including but not limited to Davis-Bacon wage rates and Buy American Iron and Steel (AIS). The project is a non-equivalency project and will be partially financed with federal funding and all requirements of the funding must be met.

Bids will be accepted until **3:00 p.m., January 17, 2023** for the **Palmer 3A and Juniper Well House Designs,** at which time bids will be publicly opened and read aloud.

A **virtual non-mandatory pre-bid conference will be held at 3:00 P.M. local time on December 15, 2022** via Zoom. Attendance at this meeting is optional for prime bidders and subcontractors. Administrative and technical questions regarding this project will be answered at this time. Answers that change or substantially clarify the bid will be affirmed in an addendum. Pre-register via email to Andrew.VanWormer@ohm-advisors.com.

Join Zoom Meeting:
https://ohm-advisors.zoom.us/j/4529066629?pwd=Q0RKaVUzVnFIZWp5ZEZMMHl6ejd5Zz09
Password: 551570

One tap mobile
+16469313860,,4529066629# US

Join by Telephone
+1 646 931 3860 US
Meeting ID: 452 906 6629
Password: 551570

Bidders are strongly encouraged to perform site visits to the project locations.

All bids must be in writing and must contain an original signature by an authorized officer of the firm. Electronic bids (i.e., telephonic, fax, email, etc.) are **NOT** acceptable.

Bid must be accompanied by bid security made payable to Owner in an amount of 5% of Bidder's maximum bid price (determined by adding the base bid and all alternates) in the form of a certified check, bank money order, or a Bid Bond.

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

The bidder agrees that if the City accepts their proposal, the bidder will, within 10 consecutive calendar days after receiving notice of this acceptance, enter into a contract to furnish all labor, equipment and tools necessary to execute the work at the lump sum named in the bid proposal and will furnish the surety for performance and payment, for one hundred percent (100%) of this bid, which shall be accepted and approved by the City.

All bids shall clearly contain on the outside of the **sealed** envelope in which they are submitted:

PALMER 3A AND JUNIPER WELL HOUSE DESIGNS

Copies of the proposal, contract forms and specifications will be available after 11 am on December 5, 2022. Hard copies may be obtained for a fee in accordance with the City's FOIA Policy at the office of the Bid Coordinator, City Hall, 301 West Main Street, Owosso, Michigan 48867. Bid documents will be available at no charge on our website at www.ci.owosso.mi.us or on the MITN website at www.mitn.info.

The City reserves the right to accept any proposal; or to reject any proposal; to waive irregularities in a proposal; or to negotiate if it appears to be in the best interest of the City of Owosso.

All work is to be substantially completed within 45 calendar weeks after Notice to Proceed date.

Final completion shall occur within 4 calendar weeks of substantial completion.

INQUIRIES/ADDENDUMS

Addendums will be available on the City's website at www.ci.owosso.mi.us and on the MITN website at www.mitn.info.

All inquiries regarding this bid request must be received at least seven (7) calendar days prior to the submission and shall be received in, and responded to, in writing, or by e-mail to both Andrew.VanWormer@ohm-advisors.com AND Matt.Kennedy@ohm-advisors.com.

INSTRUCTIONS TO BIDDERS

1. Each proposal must be signed by the bidder with his usual signature. Bids by partnerships should be signed with the partnership name by one of the members of the partnership or by an authorized representative, followed by the signature and title of the person signing. Proposals by corporations must be signed with the name of the corporation, followed by the signature and designation of the president, vice-president or person authorized to bind it in the matter. **Any paperwork not filled out properly or signed will cause the bid to be considered non-responsive and shall be rejected by the City.**

2. Proposals, to receive consideration, must be received prior to the specified time of opening and reading as designated in the Notice to Bidders.

3. Bidders are requested to use the proposal form furnished by the City when submitting their proposals. Envelopes must be **sealed** when submitted and clearly marked on the outside indicating the name of the bid.

4. Proposals having erasures or corrections thereon may be rejected unless explained or noted over the signature of the bidder.

5. References in the specifications or description of materials, supplies, equipment, or services to a particular trade name, manufacturer's catalog, or model number are made for descriptive purposes to guide the bidder in interpreting the type of materials or supplies, equipment, or nature of the work desired. They should not be construed as excluding proposals on equivalent types of materials, supplies, and equipment or for performing the work in a manner other than specified. However, the bidders' attention is called to General Condition seven (7).

6. Proposals should be mailed or delivered to: Bid Coordinator's Office, City Hall, 301 W. Main Street, Owosso, MI 48867.

7. Special conditions included in this inquiry shall take precedence over any conditions listed under General Conditions or Instructions to Bidders.

8. Insurance coverage – The winning bidder, prior to execution of the contract, shall file with the City copies of completed certificates of insurance naming the City of Owosso and OHM Advisors as additional insured parties, as evidence that the contractor carries adequate insurance satisfactory to the City.

9. The City of Owosso has a local preference policy for the purchase of goods and services. The policy in part states: *A business located within the City limits and paying real or personal property taxes to the City of Owosso will be granted a six percent (6%) bid advantage or $2,500, whichever is less, over a business located outside Shiawassee County. A business located outside the City limits but within Shiawassee County and paying property taxes to the county will be granted a three percent (3%) bid advantage or $2,500, whichever is less, over a business located outside Shiawassee County. The preference also applies to subcontractors performing twenty-five percent (25%) or more of the work of a general contract.*

10. A Bid must be accompanied by Bid security made payable to the City of Owosso in an amount of five (5%) percent of Bidder's maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid Bond (on the form included in the Bidding Documents) issued by a surety meeting in the requirements of the General Conditions.

11. To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within two days of Owner's request, Bidder shall submit (a) written evidence establishing its qualification such as financial data, previous experience, and present commitments. A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.

12. The following items must be included with the bid response:

    a. Bid Proposal
    b. Local Preference Affidavit for each eligible (sub)contractor
    c. W-9 Request for Taxpayer ID No. and Certification
    d. Signature Page & Legal Status/ Acknowledgement of Addendum(s)
    e. Insurance Endorsement
    f. Section 00 43 13 Bid Bond
    g. Section 00 44 36 Subcontractor, Supplier Listing
    h. Section 00 45 10 Qualifications Statement
    i. DWRF requirements
        i. Section 00 45 14 Iran Linked Business Certification
        ii. Debarment/Suspension Certification
        iii. Davis-Bacon/Prevailing Wages
        iv. American Iron and Steel Requirements

BID Proposal

PALMER 3A AND JUNIPER WELL HOUSE DESIGNS

TO: THE CITY OF OWOSSO (HEREINAFTER CALLED THE "CITY")

Bidder must provide pricing for each item listed. If additional pricing elements are being offered by the bidder, they are to be listed under "other services/items offered."

The undersigned, having examined the Bidding Documents and any data and reference items identified in the Bidding Documents and hereby acknowledges receipt of the following Addenda:

Addendum No.	**Addendum, Date**
_____	_____
_____	_____
_____	_____
_____	_____

does hereby offer to the City the following prices to wit:

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
PALMER 3A WELL HOUSE WORK					
1	Demolition of Palmer 3 Wellhouse	LS	1		
2	Abandonment of Palmer 3 Well	LS	1		
3	Palmer 3 Water Main Abandonment	LS	1		
4	Well House Building and Site Work	LS	1		
5	Process Piping and Equipment Work	LS	1		
6	Electrical and Mechanical Work	LS	1		
7	12-inch Water Main – Open Cut	LS	1		
8	Allowance: Testing	LS	1	$6,000	$6,000
9	Allowance: Gas and Electric Utilities	LS	1	$30,000	$30,000
10	Allowance: Permits	LS	1	$2,000	$2,000
11	Inspector Days	Day		$680/Day	
Subtotal of All Palmer 3A Lump Sum Bid Items					
JUNIPER WELL HOUSE WORK					
12	Well House Building and Site Work	LS	1		
13	Process Piping and Equipment Work	LS	1		
14	Electrical and Mechanical Work	LS	1		
15	12-inch Water Main – Directional Drill	LS	1		
16	12-inch Water Main – Open Cut	LS	1		
17	Electrical Service Conduit Installation	LS	1		
18	Allowance: Testing	LS	1	$8,000	$8,000
19	Allowance: Gas and Electric Utilities	LS	1	$90,000	$90,000
20	Allowance: Permits	LS	1	$4,000	$4,000
21	Inspector Days	Day		$680/Day	
Subtotal of All Juniper Lump Sum Bid Items					

Contract Total of All Lump Sum Bid Items	

Bidder's Initial _____

VARIANCE FROM SPECIFICATIONS: If the bidder is unable to comply with the specifications as outlined, the bidder shall clearly note these variations from the specifications. The bidder may also propose additions to these specifications for the City to consider, but the costs associated with these additions shall be stated separately.

If the work in not complete on or before the date set for completion or any extension, the Contractor shall pay the City liquidated damages of *$1,000.00* a calendar day until the work is satisfactorily completed. Liquidated damages for delay may be deducted from payments due the contractor or may be collected from the Contractor or the Contractor's surety.

The undersigned agrees that if the City accepts this proposal, Contractor will, within 10 consecutive calendar days after receiving notice of this acceptance, enter into a contract to furnish all labor, equipment and tools necessary to execute the work at the unit prices named in the bid proposal. Contractor will furnish the surety for performance and payment, for 100% of this bid, which shall be accepted and approved by the City.

The undersigned agrees that if the City accepts this proposal, Contractor will start this project and will complete the entire work under this contract by 45 calendar weeks after Notice to Proceed date.

On behalf of _____, I hereby submit this proposal **PALMER 3A AND JUNIPER WELL HOUSE DESIGNS** for your consideration. The undersigned acknowledges that this proposal is subject to the General Conditions and the General Specifications included in the contract documents. In submitting this proposal, it is understood that the right is reserved by the CITY to reject any and all proposals and waive any irregularities in the bidding process. The CITY may award this contract based on any combination of the total bid and/or alternates.

Dated and signed at _____ State of _____

This _____ day of _____, 20____.

_____

Bidder

Witness:

_____ By/s/

_____

Business Address

_____

Signature

_____

Printed Name

_____

Title

_____

Telephone Number

_____

E-Mail Address

CITY OF OWOSSO CONTRACT CONDITIONS

1. LOCAL PREFERENCE POLICY

The City of Owosso has a local preference policy for the purchase of goods and services. The policy in part states: *A business located within the City limits and paying real or personal property taxes to the City of Owosso will be granted a 6% bid advantage or $2,500, whichever is less, over a business located outside Shiawassee County. A business located outside the City limits but within Shiawassee County and paying property taxes to the county will be granted a 3% bid advantage or $2,500, whichever is less, over a business located outside Shiawassee County. The preference also applies to subcontractors performing 25% or more of the work of a general contract.*

2. BID ACCEPTANCE

The City reserves the right to reject any or all proposals. Unless otherwise specified, the City reserves the right to accept any item in the proposal. In case of error in extending the total amount of the bid, the unit prices shall govern. The City objects to any additional terms stated in any documents submitted by the contractor. Performance pursuant to our Purchase Order/Equipment Agreement constitutes a course of conduct consisting of Contractor's Agreement to the terms of our Purchase Order/Equipment Agreement.

3. PAYMENT

Unless otherwise stated by the bidder, time, concerning discount offered, will be computed from date of delivery and acceptance at destination or from date correct bill or claim voucher properly certified by the contractor is received. When so stated herein, partial payments, based on a certified approved estimate by the City of materials, supplies or equipment delivered or work done, may be made upon presentation of a properly-executed claim voucher. The final payment will be made by the City when materials, supplies, equipment or the work done have been fully delivered or completed to the full satisfaction of the City.

4. BID DEFAULT

In case of default by the bidder or contractor, the City of Owosso may procure the articles or services from other sources and hold the bidder or contractor responsible for any excess cost occasioned thereby.

5. UNIT PRICES

Prices should be stated in units of quantity specified.

6. QUOTED PRICES

Unless otherwise stated by the bidder, prices quoted will be considered as being based on delivery to a designated destination and to include all charges for packing, crating, containers, shipping, etc., and being in strict accordance with specifications and standards as shown.

7. SUBSTITUTIONS

Wherever a reference is made in the specifications or description of the materials, supplies, equipment, or services required, to a particular trade name, manufacturer's catalog, or model number, the bidder, if awarded a contract or order, will be required to furnish the particular item referred to in strict accordance with the specifications or description unless a departure or substitution is clearly noted and described in the proposal.

8. HOLD CITY HARMLESS

The bidder, if awarded an order or contract, agrees to protect, defend, and save the City harmless against any demand for payment for the use of any patented material, process, article, or device that may enter into the manufacture, construction, or form a part of the work covered by either order or contract. Bidder further agrees to indemnify and save the City harmless from suits or action of every nature and description brought against it, for or on account of any injuries or damages received or sustained by any party or parties, by or from any of the acts of the contractor, his employees, subcontractors, or agents.

9. COMPETITIVE BIDDING STATUTES
The laws of the state of Michigan, the charter and ordinances of the City of Owosso, as far as they apply to the laws of competitive bidding, contracts and purchases, are made a part hereof.

10. SAMPLES
Samples, when requested, must be furnished free of expense to the City and, if not destroyed, will upon request be returned at the bidder' expense.

11. BONDS
A certified check or bid bond may be required, payable to the City of Owosso. If so required in the bid documents, a performance bond and labor and material bond in the amounts stated in the bid documents, shall be on file with the City before work commences. The City will determine the amount and sufficiency of the sureties.

12. PROPOSAL GUARANTEE
All checks or bid bonds, except those of the three lowest bidders, will be returned when the bids have been opened and tabulated. The certified checks or bid bonds of the three lowest bidders will be held until the contract documents have been signed, after which remaining certified checks or bid bonds will be returned to the respective bidders.

13. BIDDERS
The City may demand that the contractor file a sworn experience and financial statement setting forth the financial resources, adequacy of plant and equipment, organization, experience and other pertinent and material facts as may be desirable.

14. INSURANCE AND HOLD HARMLESS
To the fullest extent permitted by law the Contractor agrees to defend, pay on behalf of, indemnify, and hold harmless the City of Owosso, its elected and appointed officials, employees, agents and volunteers, and others working on behalf of the City of Owosso against any and all claims, demands, suits, or loss, including all costs connected therewith, and for any damages which may be asserted, claimed, or recovered against or from the City of Owosso, by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof, for all actions of the Contractor.

Contractor shall not commence work under this contract until they have obtained the insurance required under this paragraph, and shall keep such insurance in force during the entire life of this contract. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan and acceptable to the City of Owosso. The requirements below should not be interpreted to limit the liability of Contractor. All deductibles and SIR's are the responsibility of Contractor. Contractor shall procure and maintain the following insurance coverage:

a. Worker's Compensation Insurance including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

b. Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than $3,000,000 per occurrence and aggregate. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent, if not already included. (E) Explosion, Collapse, and Underground (XCU) coverage, if applicable. Limits may be obtained by the use of primary and excess/umbrella liability policies.

c. Automobile Liability including Michigan No-Fault Coverages, with limits of liability not less than $3,000,000 per occurrence, combined single limit for Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

d. Owners' and Contractor Protective Liability: The Contractor shall procure and maintain during the life of this contract, a separate Owners' and Contractor's Protective Liability Policy with limits of

liability not less than $3,000,000 per occurrence and aggregate for Personal Injury, Bodily Injury, and Property Damage. The City of Owosso shall be the “Named Insured” on said coverage.

e. Additional Insured: Commercial General Liability and Automobile Liability as described above shall include an endorsement stating the City of Owosso, OHM Advisors shall be listed as additional insured. It is understood and agreed by naming the City of Owosso, OHM Advisors as additional insured, coverage afforded is considered to be primary and any other insurance the City of Owosso, OHM Advisors may have in effect shall be considered secondary and/or excess.

f. Cancellation Notice: All policies, as described above, shall include an endorsement stating that is it understood and agreed Thirty (30) days, Ten (10) days for non-payment of premium, Advance Written Notice of Cancellation, shall be sent to: The City of Owosso, Brad Barrett, Finance Director, 301 W Main Owosso MI 48867.

g. Proof of Insurance Coverage: Contractor shall provide the City of Owosso at the time that the contracts are returned by him/her for execution, a Certificate of Insurance as well as the required endorsements. In lieu of required endorsements, if applicable, a copy of the policy sections where coverage is provided for additional insured and cancellation notice would be acceptable.

h. Builder’s Risk Insurance Coverage equal to amount of this contract.

If any of the above coverages expire during the term of this contract, the Contractor shall deliver renewal certificates and endorsements to the City of Owosso at least ten (10) days prior to the expiration date

15. PROTECTION OF LAND MONUMENTS AND PROPERTY STAKES

Land monuments or stakes marking property corners shall not be moved or otherwise disturbed except as directed by the City. If any land monuments or lot stakes are moved or disturbed by the contractor, the cost of replacing each land monument or lot stake so moved or disturbed shall be deducted from any money due the contractor, as payment to the City for the cost of replacing said land monument or lot stakes.

16. CONTRACTOR'S RESPONSIBILITY FOR WORK

The contractor shall be responsible for any damages that the work may sustain before its acceptance, and shall rebuild, repair, restore and make good, at its own expense, all injuries and damages to any portion of the work by the action of the elements or from any cause whatsoever before its acceptance. Neither the final payment nor any provision in the contract documents shall relieve the contractor of the responsibility for negligence or faulty materials or workmanship within the extent and period provided by law, and, upon written notice, the contractor shall remove any defects due therefrom and pay for any damaged due to other work resulting therefrom, which shall appear within one year after the date of completion and acceptance.

17. PAYMENT

At monthly intervals commencing after construction has been started, the City will make partial payment to the contractor based on a duly-certified estimate prepared by the City of the work done by the contractor during the preceding four-week period. Each estimate will be submitted to the City council for approval on either the first or third Monday of each month. The City will retain ten percent (10%) of the amount of each such estimate until final completion and acceptance of all work covered by this contract. Before the contractor shall demand final estimates or payment, contractor will furnish to the City, supported by sworn statements, satisfactory evidence that all persons that have supplied labor, materials, or equipment for the work embraced under this contract have been fully paid for the same; and that, in case such evidence be not furnished as aforesaid, such sums as the City may deem necessary to meet the lawful claims of such persons may be retained by the City from any monies that may be due or become due to the contractor under this contract until such liabilities shall be fully discharged and the evidence thereof be furnished to the City.

18. CITY'S RIGHT TO WITHHOLD CERTAIN AMOUNTS AND MAKE APPLICATION THEREOF
Besides the payment to be retained by the City under the preceding provisions of these general conditions, the City may withhold a sufficient amount of any payment otherwise due to the contractor to cover a) payments earned or due for just claims for furnish labor or materials on the project under this contract, b) for defective work not remedied and c) for failure of the contractor to make proper payments to subcontractors. The City shall disburse and shall have the right to act as agent for the contractor in disbursing such funds as have been previously withheld pursuant to this paragraph to the party or parties who are entitled to payment from it. The City will pay to the contractor a proper accounting of all such funds disbursed for the contractor.

19. OWNER'S RIGHT TO DO WORK
If the contractor should neglect to prosecute the work properly or fail to perform any provisions of this contract, the City, after three (3) days' written notice to the contractor and contractor's surety, may without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost of it from the payment due the contractor.

20. DEFINITION OF NOTICE
Where in any of the contract documents there is any provision in respect to the giving of notice, such notice shall be deemed given to the owner, when written notice is delivered to the City manager, or placed in the United States mail addressed to the City Clerk; as to the contractor, when a written notice shall be delivered to contractor's representative at the project site or by mailing such written notice in the United States mail addressed to the contractor at the place stated in the bid proposal as the business address; as to the surety on the performance bond, when a written notice is placed in the United States mail addressed to the surety at the surety's home office or to its agent or agents who executed such performance bond on behalf of the surety.

21. SUBCONTRACTS
The contractor shall not subcontract any work in the execution of this contract without the written consent of the City. The contractor shall be responsible for the acts or omissions of any subcontractor and of anyone employed directly or indirectly by such subcontractor.

22. ASSIGNMENT OF CONTRACT
The contractor shall not assign this contract or any part hereof without the written consent of the City. No assignment shall be valid unless it shall contain a provision that any funds to be paid to the assignee under this agreement are subject to a prior lien for services rendered or materials or supplies for the performance of the work specified in the contract in favor of all persons, firms, or corporations rendering such services or supplying such materials.

23. MAINTAINING TRAFFIC
The contractor shall provide flares, signs, barricades, traffic regulators, etc., to conform to the current *Michigan Manual of Uniform Traffic Control Devices* or as directed by the City. The contractor shall not close any road or street without the permission of the City. If any street or road is to be closed by the contractor, it shall be the responsibility of the contractor to notify the Owosso fire department when the street will be closed and again when the street is open to traffic. Traffic control devices for any detours deemed necessary by the City shall be provided by the contractor. Cost of maintaining shall be incidental to the cost of the project unless otherwise provided.

24. ORDER OF COMPLETION
The contractor shall submit, whenever requested by the City, a schedule of the work showing completion dates. The City may request that certain portions of the work be done before other portions. If so requested, the contractor shall arrange to schedule to meet the request by the owner.

25. USE OF COMPLETED PORTIONS
The City shall have the right to take possession and use any completed or partially completed portions of the work; but such taking possession and use shall not be deemed acceptance. Pending final completion and acceptance of the work, all necessary repairs and adjustments on any section of the work due to

defective material, workmanship, natural causes, or other operations of the contractor, other than normal wear and tear, shall be done by and at the expense of the contractor.

26. WATER SUPPLY
The contractor shall secure an adequate water supply for use in construction and for drinking water for his employees. If the City's water is used on the work, the contractor shall make the necessary application and shall pay all costs involved. Connections, piping and fittings for conveying water shall be furnished and maintained by the contractor. Contractor shall pay for water according to the City's established rates.

27. CLEANUP
The contractor shall keep the project free from waste materials or rubbish caused by its employees or work. This includes as a minimum excess excavation or backfill material, broken or rejected materials, empty containers or general debris. The owner may require complete cleanup of certain areas as construction is completed.

28. SUPERVISION
The contractor shall have a superintendent on the job site to coordinate and expedite the various construction activities for the duration of this contract.

29. EQUAL EMPLOYMENT OPPORTUNITY AND OTHER CLAUSES
The contractor shall agree not to discriminate against any employee or applicant for employment because of age, race, religion, color, handicap, sex, physical condition, developmental disability as defined by Michigan Complied Statutes, or national origin. This provision shall include but not be limited to the following: employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rate of pay or other forms of compensation, and selection for training including apprenticeship. The contractor further agrees to take affirmative action to ensure equal employment opportunities for persons with disabilities. The contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the provision of the non-discrimination clause.

AFFIDAVIT

In accordance with Section 2-348 of the Owosso City Code, the bid from a business located in Shiawassee County shall be adjusted to reflect a preference. In order for the City to calculate the adjustment, the bidder hereby deposes and states that their business address is registered, and is currently paying real and/or personal property taxes in Shiawassee County at the following address:

_____
Registered business address

The affiant further deposes and states that a sub-contract with a business registered, and paying real and/or personal property taxes in Shiawassee County will be executed for a percentage equal to or greater than twenty-five percent (25%) as stated below:

_____
Business name and address of sub-contractor

_____
Percentage of contract

_____
Authorized signature

_____ _____
Date Title

_____
Company name

SIGNATURE PAGE AND LEGAL STATUS

The undersigned certifies that he is an official legally authorized to bind his firm and to enter into a contract should the City accept this proposal.

Bid proposal by _____
(Name of Firm)

Legal status of bidder. Please check the appropriate box and **USE CORRECT LEGAL NAME.**

A. Corporation ____ ; State of Incorporation _____

B. Partnership ____ ; List of names _____

_____

C. DBA ____ ; State full name _____ DBA

_____

_____

D. Other ____ ; Explain _____

_____

Signature of Bidder _____ Title _____
(Authorized Signature)

Printed name _____

Signature of Bidder _____ Title _____
(Authorized Signature)

Printed name _____

Address _____ City _____ Zip_____

Telephone ( ) _____

Signed this _____ day of _____ 20____.

Bidder acknowledges receipt of the following Addenda:

ADDENDUM NO.	BIDDER'S INITIALS
_____	_____
_____	_____
_____	_____

W-9 INFORMATION FOR LEGAL STATUS

Sole proprietor. Enter your individual name as shown on your income tax return on the “Name” line. You may enter your business, trade, or “doing business as (DBA)” name on the “Business name/disregarded entity name” line.

Partnership, C Corporation, or S Corporation. Enter the entity's name on the “Name” line and any business, trade, or “doing business as (DBA) name” on the “Business name/disregarded entity name” line.

Disregarded entity. Enter the owner's name on the “Name” line. The name of the entity entered on the “Name” line should never be a disregarded entity. The name on the “Name” line must be the name shown on the income tax return on which the income will be reported. For example, if a foreign LLC that is treated as a disregarded entity for U.S. federal tax purposes has a domestic owner, the domestic owner's name is required to be provided on the “Name” line. If the direct owner of the entity is also a disregarded entity, enter the first owner that is not disregarded for federal tax purposes. Enter the disregarded entity's name on the “Business name/disregarded entity name” line. If the owner of the disregarded entity is a foreign person, you must complete an appropriate Form W-8.

Note. Check the appropriate box for the federal tax classification of the person whose name is entered on the “Name” line (Individual/sole proprietor, Partnership, C Corporation, S Corporation, Trust/estate).

Limited Liability Company (LLC). If the person identified on the “Name” line is an LLC, check the “Limited liability company” box only and enter the appropriate code for the tax classification in the space provided. If you are an LLC that is treated as a partnership for federal tax purposes, enter “P” for partnership. If you are an LLC that has filed a Form 8832 or a Form 2553 to be taxed as a corporation, enter “C” for C corporation or “S” for S corporation. If you are an LLC that is disregarded as an entity separate from its owner under Regulation section 301.7701-3 (except for employment and excise tax), do not check the LLC box unless the owner of the LLC (required to be identified on the “Name” line) is another LLC that is not disregarded for federal tax purposes. If the LLC is disregarded as an entity separate from its owner, enter the appropriate tax classification of the owner identified on the “Name” line.

Other entities. Enter your business name as shown on required federal tax documents on the “Name” line. This name should match the name shown on the charter or other legal document creating the entity. You may enter any business, trade, or DBA name on the “Business name/disregarded entity name” line.

Please see attached W-9 Request for Taxpayer Identification Number and Certification form for a detailed explanation on filling out the W-9 form.

Form **W-9**
(Rev. October 2018)
Department of the Treasury
Internal Revenue Service

Request for Taxpayer Identification Number and Certification

► **Go to *www.irs.gov/FormW9* for instructions and the latest information.**

Give Form to the requester. Do not send to the IRS.

Print or type. See **Specific Instructions** on page 3.

1 Name (as shown on your income tax return). Name is required on this line; do not leave this line blank.

2 Business name/disregarded entity name, if different from above

3 Check appropriate box for federal tax classification of the person whose name is entered on line 1. Check only **one** of the following seven boxes.

☐ Individual/sole proprietor or single-member LLC ☐ C Corporation ☐ S Corporation ☐ Partnership ☐ Trust/estate

☐ Limited liability company. Enter the tax classification (C=C corporation, S=S corporation, P=Partnership) ► _____

Note: Check the appropriate box in the line above for the tax classification of the single-member owner. Do not check LLC if the LLC is classified as a single-member LLC that is disregarded from the owner unless the owner of the LLC is another LLC that is **not** disregarded from the owner for U.S. federal tax purposes. Otherwise, a single-member LLC that is disregarded from the owner should check the appropriate box for the tax classification of its owner.

☐ Other (see instructions) ►

4 Exemptions (codes apply only to certain entities, not individuals; see instructions on page 3):

Exempt payee code (if any) _____

Exemption from FATCA reporting code (if any) _____

(Applies to accounts maintained outside the U.S.)

5 Address (number, street, and apt. or suite no.) See instructions.

Requester's name and address (optional)

6 City, state, and ZIP code

7 List account number(s) here (optional)

Part I Taxpayer Identification Number (TIN)

Enter your TIN in the appropriate box. The TIN provided must match the name given on line 1 to avoid backup withholding. For individuals, this is generally your social security number (SSN). However, for a resident alien, sole proprietor, or disregarded entity, see the instructions for Part I, later. For other entities, it is your employer identification number (EIN). If you do not have a number, see *How to get a TIN,* later.

Note: If the account is in more than one name, see the instructions for line 1. Also see *What Name and Number To Give the Requester* for guidelines on whose number to enter.

Social security number

			–			–				

or

Employer identification number

		–							

Part II Certification

Under penalties of perjury, I certify that:

1. The number shown on this form is my correct taxpayer identification number (or I am waiting for a number to be issued to me); and
2. I am not subject to backup withholding because: (a) I am exempt from backup withholding, or (b) I have not been notified by the Internal Revenue Service (IRS) that I am subject to backup withholding as a result of a failure to report all interest or dividends, or (c) the IRS has notified me that I am no longer subject to backup withholding; and
3. I am a U.S. citizen or other U.S. person (defined below); and
4. The FATCA code(s) entered on this form (if any) indicating that I am exempt from FATCA reporting is correct.

Certification instructions. You must cross out item 2 above if you have been notified by the IRS that you are currently subject to backup withholding because you have failed to report all interest and dividends on your tax return. For real estate transactions, item 2 does not apply. For mortgage interest paid, acquisition or abandonment of secured property, cancellation of debt, contributions to an individual retirement arrangement (IRA), and generally, payments other than interest and dividends, you are not required to sign the certification, but you must provide your correct TIN. See the instructions for Part II, later.

Sign Here	**Signature of U.S. person** ►	**Date** ►

General Instructions

Section references are to the Internal Revenue Code unless otherwise noted.

Future developments. For the latest information about developments related to Form W-9 and its instructions, such as legislation enacted after they were published, go to *www.irs.gov/FormW9.*

Purpose of Form

An individual or entity (Form W-9 requester) who is required to file an information return with the IRS must obtain your correct taxpayer identification number (TIN) which may be your social security number (SSN), individual taxpayer identification number (ITIN), adoption taxpayer identification number (ATIN), or employer identification number (EIN), to report on an information return the amount paid to you, or other amount reportable on an information return. Examples of information returns include, but are not limited to, the following.

- Form 1099-INT (interest earned or paid)
- Form 1099-DIV (dividends, including those from stocks or mutual funds)
- Form 1099-MISC (various types of income, prizes, awards, or gross proceeds)
- Form 1099-B (stock or mutual fund sales and certain other transactions by brokers)
- Form 1099-S (proceeds from real estate transactions)
- Form 1099-K (merchant card and third party network transactions)
- Form 1098 (home mortgage interest), 1098-E (student loan interest), 1098-T (tuition)
- Form 1099-C (canceled debt)
- Form 1099-A (acquisition or abandonment of secured property)

Use Form W-9 only if you are a U.S. person (including a resident alien), to provide your correct TIN.

If you do not return Form W-9 to the requester with a TIN, you might be subject to backup withholding. See What is backup withholding, *later.*

PROOF OF INSURANCE

This is to certify that the following endorsement is part of the policy(ies) described below:

NAMED INSURED (CONTRACTOR)	**COMPANIES AFFORDING COVERAGE**
	A.
	B.
ADDRESS	**C.**

It is hereby understood and agreed that the City of Owosso, its City council and each member thereof and every officer and employee of the City shall be named as joint and several assureds with respect to claims arising out of the following project:

PALMER 3A AND JUNIPER WELL HOUSE DESIGNS

It is further agreed that the following indemnity agreement between the City of Owosso and the named insured is covered under this policy: Contractor agrees to indemnify, hold harmless and defend City, its City council and each member thereof and every officer and employee of City from any and all liability or financial loss resulting from any suits, claims, losses or actions brought against and from all costs and expenses of litigation brought against City, its City Council and each member thereof and any officer or employee of City which results directly or indirectly from the wrongful or negligent actions of contractor's officers, employees, agents or others employed by Contractor while engaged by contractor in the (performance of this agreement) construction of this project.

It is further agreed that the inclusion of more than one assured shall not operate to increase the limit of the company's liability and that insurer waives any right on contribution with insurance which may be available to the City of Owosso.

The contractor, or any of their subcontractors, shall not commence work under this contract until they have attained the insurance required below, and shall keep such insurance in force during the entire life of this contract. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan and acceptable to the City of Owosso. The requirements below should not be interpreted to limit the liability of the Contractor. All deductibles and SIR's are the responsibility of the Contractor.

The Contractor shall procure and maintain the following insurance coverage:

1. Worker's Compensation Insurance including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

2. Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than $3,000,000 per occurrence and aggregate. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent, if not already included; (E) Explosion, Collapse and Underground (XCU) coverage, if applicable. Limits may be obtained by the use of primary and excess/umbrella liability policies.

3. Automobile Liability including Michigan No-Fault Coverages, with limits of liability not less than $3,000,000 per occurrence, combined single limit for Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

4. Owners' and Contractor Protective Liability: The Contractor shall procure and maintain during the life of this contract, a separate Owners' and Contractor's Protective Liability Policy with limits of liability

not less than $3,000,000 per occurrence and aggregate for Personal Injury, Bodily Injury, and Property Damage. The City of Owosso shall be the “Named Insured” on said coverage

5. Builder’s Risk Insurance Coverage: The Contractor shall procure and maintain during the life of this contract, a separate Builder’s Risk Insurance Policy with coverage equal to amount of this contract. The City of Owosso shall be the “Named Insured” on said coverage.

6. Additional Insured: Commercial General Liability and Automobile Liability, as described above, shall include an endorsement stating the following shall be ***Additional Insureds*****:** City of Owosso, all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and board members, including employees and volunteers thereof. OHM Advisors and employees. It is understood and agreed by naming City of Owosso and OHM as additional insured, coverage afforded is considered to be primary and any other insurance the City of Owosso, OHM Advisors may have in effect shall be considered secondary and/or excess.

7. Cancellation Notice: All policies, as described above, shall include an endorsement stating that it is understood and agreed that a Ten (10) days notice for non-payment of premium is required and a Thirty (30) days notice is required for Non-Renewal, Reduction, and/or Material Change, shall be sent to: City of Owosso, Bid Coordinator, 301 W. Main Street, Owosso, Michigan 48867.

8. **Proof of Insurance Coverage**: The Contractor shall provide the City of Owosso, at the time that the contracts are returned by him/her for execution, a Certificate of Insurance as well as the required endorsements. In lieu of required endorsements, if applicable, a copy of the policy sections where coverage is provided for additional insured and cancellation notice would be acceptable. Copies or certified copies of all policies mentioned above shall be furnished, if so requested.

If any of the above coverages expire during the term of this contract, the Contractor shall deliver renewal certificates and endorsements to the City of Owosso at least ten (10) days prior to the expiration date.

Please include a copy of insurance declaration verifying amounts of coverage. The verification of insurance is not an insurance policy and does not amend, extend or alter the coverage afforded by the policies listed herein. Notwithstanding any requirement, term, or condition of any contract or other document with respect to which this certificate or verification of insurance may be issued or may pertain, the insurance afforded by the policies described herein is subject to all the terms, exclusions and conditions of such policies.

DATE _____ BY _____
Authorized Insurance Agent

AGENCY _____ TITLE _____

ADDRESS _____

_____

SECTION 00 25 13 - PREBID MEETINGS

1.1 PREBID MEETING

A. Engineer will conduct a Prebid meeting as indicated below:
   1. Meeting Date: PER NOTICE TO BIDDERS [Shall be updated in bid addendum].
   2. Meeting Time: PER NOTICE TO BIDDERS [Shall be updated in bid addendum].
   3. Location: Zoom Meeting.

B. Attendance:
   1. Prime Bidders: PER NOTICE TO BIDDERS
   2. Subcontractors: PER NOTICE TO BIDDERS

C. Agenda: Prebid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
   1. Procurement and Contracting Requirements:
      a. Advertisement for Bids.
      b. Instructions to Bidders.
      c. Bidder Qualifications.
      d. Bonding.
      e. Insurance.
      f. Bid Security.
      g. Bid Form and Attachments.
      h. Bid Submittal Requirements.
      i. Bid Submittal Checklist.
      j. Notice of Award.
   2. Communication during Bidding Period:
      a. Obtaining documents.
      b. Access to Project Web site.
      c. Bidder's Requests for Information.
      d. Bidder's Substitution Request/Prior Approval Request.
      e. Addenda.
   3. Contracting Requirements:
      a. Agreement.
      b. The General Conditions.
      c. The Supplementary Conditions.
      d. Other Owner requirements.
   4. Construction Documents:
      a. Scopes of Work.
      b. Temporary Facilities.
      c. Use of Site.
      d. Work Restrictions.
      e. Alternates, Allowances, and Unit Prices.
      f. Substitutions following award.
   5. Separate Contracts:
      a. Work by Owner.
      b. Work of Other Contracts.
   6. Schedule:
      a. Project Schedule.
      b. Contract Time.
      c. Liquidated Damages.
      d. Other Bidder Questions.
   7. Site/facility visit or walkthrough.
   8. Post-Meeting Addendum.

D. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes to attendees. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.
   1. Sign-in Sheet: Minutes will include list of meeting attendees.
   2. List of Plan holders: Minutes will include list of plan holders.

END OF SECTION 00 25 13

SECTION 00 31 32 - GEOTECHNICAL DATA

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information, but are not a warranty of existing conditions. This Document and its attachments are not part of the Contract Documents.

B. A geotechnical investigation report for the Palmer 3A Project Site, prepared by SME, dated October 4, 2022, entitled “Geotechnical Evaluation Report, Palmer 3A Wellhouse, Owosso, Michigan, SME Project 090304.00” is available to bidder and is appended to this Section.

C. A draft geotechnical investigation report for the Juniper Project Site, prepared by SME, dated October 10, 2022, entitled “Geotechnical Evaluation Report, Juniper 1 Wellhouse, Owosso, Michigan, SME Project 090315.00” is available to bidder and is appended to this Section. A final report will be provided to the Bidders when available.

D. Related Requirements:
   1. Section 00 21 13 "Instructions to Bidders" for the Bidder's responsibilities for examination of Project site and existing conditions.

END OF SECTION 00 31 32

GEOTECHNICAL EVALUATION REPORT

PALMER 3A WELLHOUSE
OWOSSO, MICHIGAN

SME Project 090304.00
October 4, 2022

SME

2663 Eaton Rapids Road
Lansing, MI 48911-6310

T (517) 887-9181

www.sme-usa.com

October 4, 2022

Mr. Matt Kennedy, PE, LEED AP
OHM Advisors
34000 Plymouth Road
Livonia, Michigan 48150

Transmitted Via Email: Matt.Kennedy@ohm-advisors.com

RE: Geotechnical Evaluation
Palmer 3A Wellhouse
1596-1636 Palmer Street
Owosso, Michigan
SME Project No. 090304.00

Dear Mr. Kennedy:

We have completed our geotechnical evaluation for the subject project. This report presents the results of our observations and analyses, our geotechnical recommendations, and general construction considerations based on the information disclosed by the boring.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact me.

Very truly yours,

SME

Bradford L Ewart II, PE
Project Manager / Senior Consultant
MI-6201060545

Enclosure: SME Geotechnical Evaluation Report; Dated October 3, 2022

TABLE OF CONTENTS

1. INTRODUCTION

This report presents the results of the geotechnical evaluation completed by SME for the subject project. We performed this evaluation in general accordance with the scope of services outlined in our proposal P02884.22, dated July 22, 2022. Our services for this evaluation were authorized OHM Advisors.

1.1 SITE CONDITIONS

The project site is located at 1596 Palmer Street in Owosso, Michigan. The approximate location of the site is depicted on the Location Map inset on the Boring Location Diagram (Figure No.1), included in Appendix A.

The proposed development site currently consists of grass covered areas, an unpaved road, and two unpaved parking lots. A tree line and Palmer Street border the proposed site in the south, north, and east, along with Hopkins Lake to the west. Based on Google Earth imagery, the site ground surface appears relatively flat, with changes in elevation estimated to be about 2 feet, or less; however, SME has not been provided a topographic survey of the site.

1.2 PROJECT DESCRIPTION

Specific project details including site plan, topographic survey, grading plan, and structural loads have not been provided to SME. However, we understand the plan is to develop an approximate 300 square foot, single-story, slab-on-grade wellhouse that will be 15 feet by 20 feet on site situated over top of a water well, as well as a small exterior generator on a slab adjacent to the wellhouse. The approximate location of the proposed wellhouse is illustrated on Figure No. 1.

While no detailed project information has been provided to SME, Mr. Andrew Vanwormer, PE of OHM Advisors informed SME that the foundation would be 42-inch block or poured wall on 24 inch spread footing based on a preliminary layout. Based on our experience with similar types of projects, we anticipate structural loads will include maximum column loads of 25 kips and maximum wall loads of 3 kips per linear foot. However, specific structural loading information has not been provided at the time of issuing this report. We assume cuts/fills to establish final grades will be 1-foot or less within the proposed development area.

2. EVALUATION PROCEDURES

2.1 FIELD EXPLORATION

SME performed one boring (B1) at the site on September 1, 2022. The approximate as-drilled boring locations are shown on Figure No. 1.

SME and OHM Advisors jointly determined the number, proposed location, and depth of the boring. SME visited the site prior to drilling and staked the boring location and obtained the existing ground surface elevation at the boring location using our hand-held global positioning system (GPS) unit with sub-foot accuracy.

The boring was advanced with a rotary drill rig using continuous-flight augers. The boring included soil sampling based upon the Split-Barrel Sampling procedure. Portions of the recovered split-barrel samples were sealed in glass jars by the driller.

We measured and recorded groundwater depth (or lack thereof) during and immediately after completion of the boring. The driller backfilled the boreholes with the auger cuttings at completion of drilling. We took the recovered soil samples to our laboratory for further observation and testing.

2.2 LABORATORY TESTING

The laboratory testing program consisted of visual soil classification on recovered samples in general accordance with ASTM D-2488 along with moisture content and hand penetrometer shear tests on portions of cohesive samples obtained. Based on the laboratory testing, we assigned a group symbol to the various soil strata encountered based on the Unified Soil Classification System (USCS). The Laboratory Testing Procedures in Appendix B provide descriptions of the laboratory tests given above.

Upon completion of the laboratory testing, we prepared a boring log including materials encountered, penetration resistances, pertinent field observations made during the drilling operations, and the results of certain laboratory tests. We developed the soil descriptions included on the boring logs from both visual classification and the results of laboratory tests. The boring log also includes the existing ground surface elevation as estimated by SME. The boring log is included in Appendix A. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet included in Appendix A.

Soil samples retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, we retain soil samples in our laboratory for 60 days unless instructed otherwise.

3. SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

The soil conditions encountered at the boring consist of surficial topsoil overlying existing clay fill underlain by natural clays and sands extending to the explored boring depth. We provide a summary of the materials encountered at the boring location, beginning at the existing ground surface and proceeding downward, below. Refer to the boring log for more detailed information.

Stratum 1: Topsoil. We encountered approximately 5 inches of topsoil at the surface of the boring.

Stratum 2: Existing Clay Fill. Below the topsoil, we encountered existing clay fill with varying amount of sand and concrete pieces that extended to 3 feet below the existing ground surface, corresponding to approximate elevation 762.4 feet.

Stratum 3: Natural Clays. We encountered natural clays below the surficial topsoil and fill at the boring. The natural clay extended to 11.5 feet below the existing ground. Moisture contents of the clays varied from about 11 to 14 percent. Measured shear strengths varying from 3.0 to 4.0 kips per square-foot (ksf) indicate the clays are in a very stiff condition.

Stratum 4: Natural Sands. We encountered natural sands below the natural clays. The natural sands were encountered in a medium dense condition, with N_{60} value of 12 blows per foot (bpf).

The soil profile described above and included on the boring log are generalized descriptions of the conditions encountered. The stratification depths described above and shown on the boring log indicate a zone of transition from one soil type to another and do not show exact depths of change from one soil type to another. We based the soil descriptions on visual classification of the soils encountered. Soil conditions may vary between or away from the boring location. Please refer to the boring log for the soil conditions at the specific boring location.

Thickness measurements of surficial materials reported on the boring log (topsoil) need to be considered approximate since mixing of these materials can occur in small diameter boreholes. Therefore, if accurate thickness measurements are required for inclusion in bid documents or purposes of design, perform additional evaluations such as shallow test pits to more accurately measure the topsoil thickness.

It is sometimes difficult to distinguish between fill and natural soils based on samples and cuttings from small-diameter boreholes, especially when portions of the fill do not contain man-made materials, debris, topsoil or organic layers, and when the fill appears similar in composition to the local natural soils. Therefore, the delineation of fill described above and on the boring log are to be considered approximate only. A more comprehensive evaluation of the extent and composition of the fill can be made by reviewing former site topography plans such as grading plans from previous construction, aerial photographs and other historic site records, and by observing test pit excavations.

3.2 GROUNDWATER CONDITIONS

Groundwater was not encountered in boring B1 that terminated at approximate elevation 750.4 feet. SME was not provided the water level for Hopkins Lake adjacent to the site.

In cohesive soils (clays), a long time may be required for the groundwater level in the borehole to reach an equilibrium position. Therefore, the use of groundwater observation wells (piezometers) is necessary to accurately determine the hydrostatic groundwater level within cohesive soils as encountered at this site.

Groundwater depths/elevations, and the rate of infiltration into excavations, should be expected to fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, water level of Hopkins Lake, and other factors. The groundwater conditions indicated by the boring, or lack thereof, represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary.

4. ANALYSIS AND RECOMMENDATIONS

4.1 SITE PREPARATION AND EARTHWORK

4.1.1 EXISTING FILL CONSIDERATIONS

We encountered existing sandy clay fill extending about 3 feet below the existing ground surface boring B1. The fill appeared to have been placed in an uncontrolled manner as SME was not provided with information on how the fill was placed or the origin of the fill. An assumption could be that this area was used during the construction of Palmer Street as a “lay down” area for material for the road.

Based on the condition of the existing fill encountered in the boring, the existing fill is not suitable for foundation support and we recommend it is removed per the recommendations in Section 4.2. However, based on the condition of the existing fill encountered in the boring, and the proposed type of construction, we believe the existing fill can remain below the floor slab provided:

- The subgrade is properly evaluated by SME and prepared as described in Section 4.
- Unsuitable fill is undercut and replaced with engineered fill.
- The Owner accepts the associated risks described below.

The increased risks associated with supporting slabs-on-grade over the existing fill at this site could include greater than typical post-construction settlement, resulting in differential movements and associated cracking of the slabs. These risks can be reduced, but not eliminated, if SME further evaluates the existing fill at floor slab subgrades. If the risks described above are not acceptable to the Owner, the existing fill should be completely removed from within the proposed building footprint and replaced with engineered fill.

If the existing fill will remain in-place for support of the floor slabs, further evaluation of the existing fill during construction must be conducted by SME. Further evaluation should include observing the condition of the fill in hand-auger borings or shallow test pits, testing the fill using a dynamic cone penetrometer (DCP), observing the condition of the fill in the sides of the foundation excavations, and observing the response of the surface of the fill when subjected to a proofroll. Existing fill to remain in-place should be of sufficient strength and free of deleterious materials, such as excessive debris and organics. Unsuitable existing fill that cannot be improved in-place should be removed (i.e., undercut) and replaced with engineered fill that is placed and compacted per the requirements outlined in Section 4.1.4 of this report.

The recommendations provided in the following report sections are based on the assumption that existing fill will be removed below proposed foundations, and suitable existing fill will remain in-place and be used to support the floor slabs. If the Owner does not accept the stated assumptions and risks, please contact SME for revised recommendations.

4.1.2 SITE SUBGRADE PREPARATION

Within the proposed structure footprints, remove the surficial topsoil and existing structures such as sidewalks, pavements, slabs, foundations, etc. (if encountered) and other unsuitable materials. Where removing below-grade structures (if any), backfill the area with granular engineered fill to the final subgrade level. We recommend abandoned utilities be removed and backfilled with granular engineered fill to the design subgrade level. We recommend site clearing extend a minimum of 5 feet beyond the limits of the proposed improvement areas to ensure uniform support of proposed improvements. We recommend retaining SME to evaluate the subgrade and assist with determining where suitable soils are present during the site earthwork operations.

The existing inorganic existing clay fill soils exposed after removal of the existing surficial materials are anticipated to be suitable for support of grade slabs associated with the wellhouse and generator, provided the recommendations for subgrade preparation (provided in this report) are followed. However, the predominantly clayey profile at the site is susceptible to “holding water” and experiencing subgrade disturbance if accumulations from precipitation and/or water is allowed to pond on the site. It will be important for the contractor to incorporate effective site drainage practices to prevent water from ponding on prepared subgrades.

After stripping and removal of unsuitable materials, and after cutting to design subgrade levels, but before placing fill to raise grades, the exposed subgrade may need to be uniformly compacted using large construction equipment (depending on its condition). We recommend an SME field engineer be onsite to assist the earthwork contractor with evaluating the need for subgrade compaction. Take care during compaction not to damage nearby, existing structures. The type of compaction equipment will depend upon site-specific conditions and the proximity and sensitivity of existing structures. We recommend at least several passes be made with the compaction equipment. In some areas, moisture conditioning and/or undercutting may be necessary to enhance the effectiveness of the compaction operation. As with typical site earthwork projects in Michigan, it will be practical and economical to perform site earthwork activities and foundation/grade slab construction during the warmer, dryer summer months, when it is easier to perform moisture conditioning as needed.

After performing compactive efforts, and diverting perched groundwater from accumulating onsite, we recommend testing the subgrade for stability. Typically, such testing involves a proofroll with a large piece of construction equipment. Where areas are accessible for proofrolling, we recommend using a fully loaded tandem axle truck (50,000 ft-lbs. minimum) or similar piece of rubber tire equipment to perform the proofroll test. We recommend an SME representative be on-site to observe and document the subgrade reaction during the proofroll test and perform additional subgrade evaluation as necessary. Based on the results of the proofroll and other field tests, the SME representative can provide recommendations in the field regarding the suitability of the subgrade for structural support. Areas of unsuitably loose/wet/soft subgrade will need to be either improved in-place (e.g., dried and recompacted) or be removed (undercut) and replaced with engineered fill. Improvement of the exposed subgrade may

consist of aerating and drying disturbed soils, recompacting these soils in-place, as well as placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation.

After making cuts or fills to design grades and after the exposed subgrade has been evaluated (as mentioned above) and improved as necessary, place engineered fill on the exposed subgrade to establish final subgrade levels. Refer to Section 4.1.4 for materials and compaction requirements for engineered fill.

4.1.3 SUBGRADE PREPARATION FOR FLOOR SLABS

We anticipate the final floor slab subgrade for the proposed building will consist of suitable existing clay fill underlain by natural soils or engineered fill overlying existing clay fill underlain by natural soils. These soils are considered suitable for support of floor slabs, provided the subgrade is prepared as described in Sections 4.1.1 and 4.1.2, the Owner is willing to accept the stated risks of leaving the existing fill in-place for support of floor slabs, and engineered fill is placed and compacted per Section 4.1.4. We recommend a subgrade modulus k (30) of 100 psi per inch be used to design floor slabs supported on properly prepared subgrade as described above. The recommend subgrade modulus k (30) is based on correlations with soil type developed from plate load tests conducted using a 30-inch diameter plate with 0.05-inches of deflection.

Prior to concrete placement for floor slabs, SME should observe and test the building pad subgrade to identify areas that were disturbed during construction activities and to verify the final subgrade conditions are suitable for floor slab support. Unsuitable subgrade identified by SME should be improved by compaction in place or removed and replaced with engineered fill. Final subgrade areas that are accessible with large equipment should be proofrolled, and areas inaccessible to proofrolling equipment should be evaluated with hand-operated equipment, such as cone penetrometers, hand auger probes, and density gauges.

The top 6 inches of the slab subbase should consist of an approved MDOT Class II granular material to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils. MDOT 21AA dense-graded aggregate can be used as subbase material, instead of the Class II granular material, for improved stability and greater resistance to disturbance due to construction traffic. The thickness of dense-graded aggregate required to stabilize and protect the subgrade will depend on the condition of subgrade soils during construction and the type and volume of construction equipment to traffic the prepared subgrade. The leveling surface must be compacted per the "Engineered Fill Requirements" section of this report as discussed in Section 4.1.4.

A vapor retarder should be provided below floor slabs that are to receive an impermeable floor finish/seal or a floor covering which would retard vapor transmission. The location of the vapor retarder (relative to the subbase) should be determined by the design Architect/Engineer based on the intended floor usage, planned finishes, and ACI recommendations.

We recommend separating slabs by isolation joints from structural walls and columns to permit relative movement. A minimum of 6 inches of engineered fill should be placed between the bottom of the slab and the top of the shallow foundation below, to allow for relative settlements.

The slab-on-grade subgrade soils should be protected from frost action during winter construction. Frozen soils must be thawed and compacted or removed and replaced prior to slab-on-grade construction.

4.1.4 ENGINEERED FILL REQUIREMENTS

Fill placed within the construction area, including utility trench backfill, must be an approved material, free of frozen soil, organics, debris, particle sizes that will hinder compaction, and other deleterious materials. We recommend the fill be spread in level layers not exceeding 9 inches in loose thickness and be compacted to a minimum 95 percent of the maximum dry density as determined in accordance with the Modified Proctor Test. Thicker lifts of backfill may be acceptable, provided the type of compaction equipment can achieve the minimum compaction criterion throughout the entire thickness of the lift within the area of placement and with the type of backfill used. SME can provide recommendations in the field for adjusting lift thicknesses based on the specific type of compaction equipment/methods used during construction and verification the entire lift of fill is compacted to the project requirements. Sand fill should be compacted with a smooth-drum vibratory roller or vibratory plate compactors, including either walk-behind types or plate compactors mounted on a backhoe or excavator (i.e., a hoe-pac). Clay fill should be compacted by overlapping passes with a sheep's foot roller or other pneumatic tire type compaction equipment at a moisture content between the optimum and two percent below the optimum.

Minimal fill placement for general site grades are expected for this project. However, we believe the natural clay and sand soils and existing clay fill are suitable for reuse as engineered fill (if needed for site grading), provided they meet the requirements listed in this section. Granular fill is recommended for smaller backfill areas where large compaction equipment cannot operate.

The successful reuse of the on-site soils for engineered fill will depend on the time of year and the care the earthwork contractor uses during construction. During cold and wet periods of the year, the subgrade soils (in particular, soils containing significant silt and/or clay content) may become saturated and disturbed and the soils can be difficult to dry. If such conditions occur, the contractor may have to use more imported granular fill (sand) as engineered fill on the site.

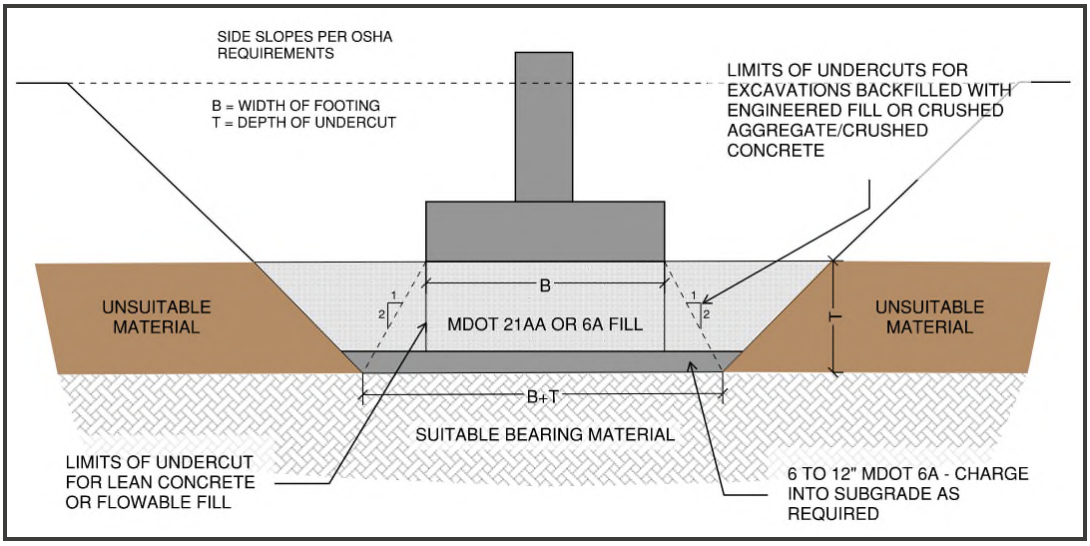
For backfill in confined areas, and where drainage is required, we recommend using imported granular backfill such as MDOT Class II sand, MDOT 21AA crushed aggregate, and/or MDOT 6A crushed stone. The specific type of imported fill will depend on a variety of factors. For most instances, we anticipate MDOT Class II sand will be adequate. Crushed aggregate/stone would be necessary where the existing subgrade is in a wet condition and/or where site drainage is required. In addition to the use of crushed stone, it would likely be necessary to cap the stone with crushed aggregate or wrap the crushed stone with a heavy-duty non-woven geotextile fabric, to prevent the surrounding soils from infiltrating into the crushed stone.

For trenches and other excavations, we recommend the upper 18 inches of backfill consist of soils similar with the surrounding subgrade. The purpose for this is to limit mixing of different soil types near final subgrade levels.

4.2 FOUNDATIONS

Shallow spread foundations are feasible for support of the equipment pad and wellhouse. We recommend designing the foundations for a maximum net allowable bearing pressure of 2,000 psf. Support the foundations on suitable natural soils or on engineered fill placed over suitable natural soils. While a higher soil bearing pressure is achievable in the very stiff natural clays, we recommend limiting the design bearing pressure to reduce the potential for foundation undercuts if localized soft/disturbed zones are encountered. Also, due to the light structural loads expected, the spread foundation size(s) for the wellhouse will likely be governed by the size of the structure.

In areas where the exposed subgrade cannot attain the recommended soil bearing pressure, the foundation(s) could be re-designed at a reduced bearing pressure (requires input from the project structural engineer) or foundation undercutting would be required. Foundation undercuts can extend through any unsuitable subgrade until reaching suitable bearing soils. Alternatively, the undercut excavation could be backfilled with engineered fill so the foundation bears on engineered fill placed over suitable natural soils. Where oversizing is required, extend the undercut laterally on a two vertical to one horizontal slope from the outside edge of the foundation where undercutting and backfilling to the design bearing level. Please refer to the following Typical Foundation Undercutting Diagram:



Typical Foundation Undercutting Diagram

To verify suitable bearing soils are exposed and subgrade conditions are representative of those encountered at the borings, an SME representative needs be on site during foundation construction to observe and test the subgrade.

Foundations should be situated a minimum of 42 inches below final site grade in unheated areas for protection against frost action during normal winters. It is unknown if the wellhouse will not be climate controlled (i.e. open structures exposed to variable weather conditions), therefore we recommend interior foundations should be situated a minimum of 42 inches below final site grades for protection against frost action during normal winters.

Trenched foundations through the very stiff natural clays appear feasible. However, poorly compacted existing fill soils may be subject to sloughing/caving, particularly where performing deeper undercuts. For trench foundation construction, we recommend the foundation sidewalls be shaped in a vertical manner and not be allowed to ‘mushroom out’ near the top. If side-wall caving occurs, remove the sloughed soils and re-establish an undisturbed bearing surface.

For bearing capacity and settlement considerations, we recommend continuous (wall) foundations have a minimum width of 18 inches. In some cases where there are relatively light structural loads, the minimum foundation size criteria may dictate the size of the foundation and not the allowable soil bearing pressure.

We estimate total settlement for shallow foundations using the recommended design soil bearing pressure and bearing on suitable soils as described above to be less than 1 inch. We base the settlement estimates on the available soil borings, the estimated structural loads, our experience with similar structures and soil conditions and field verification of suitable bearing soils by SME.

4.3 SEISMIC SITE CLASS

The site is located at the approximate geographic location latitude N42.9782 degrees and longitude W84.1748 degrees. From available topographical information available for purposes of identifying the depth to bedrock, the approximate ground surface elevation at the proposed site is 766 feet. Based on Plate 13 (Topography of the Bedrock Surface) in the Hydrogeologic Atlas of Michigan, the top of rock elevation is around 675 feet in the vicinity of the site. Based on the above information, the glacial drift is roughly 91 feet thick.

The known shear strength and N-values for drift at this site are limited to the explored depth of about 15 feet below the ground surface at the boring drilled for this evaluation, which we anticipate to be of similar or better strength with increasing depth (based on deeper soil data provided in the Water Well Record). Based on the referenced soil conditions, averaged over the upper 100 feet of the profile, Seismic Site Class D applies to this site in accordance with the 2015 Michigan Building Code (MBC) referencing Table 20.3-1 in ASCE Standard ASCE/SEI 7-16.

4.4 CONSTRUCTION CONSIDERATIONS

The subgrade soils at this site will be sensitive to disturbance when trafficked, especially when these soils become wet. If the subgrade is disturbed, it will be necessary to disc, aerate, and recompact the disturbed soils, or to remove and replace the disturbed soils with engineered fill, crushed aggregate, or crushed concrete. To protect areas of prepared subgrade from disturbance, and to create dependable haul routes and material laydown areas, placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation, could be required.

Remove ponded surface water and prevent run-off from reaching foundation excavations and areas of prepared subgrade. Establish positive surface drainage at the onset of construction to mitigate the potential for subgrade disturbance. To reduce the potential of subgrade disturbance across the site, construction traffic should be restricted to dedicated areas of the site, and not be allowed to randomly traffic the entire site.

If seepage into excavations occurs (from perched groundwater, surface run-off, precipitation, or other factors), we believe it can be controlled using standard sump pit and pumping procedures on a localized basis. In excavation areas where seepage accumulates, a working surface of either crushed aggregate or crushed concrete may be required to protect the exposed surface from disturbance. SME can provide recommendations in the field regarding the thickness (and type) of crushed stone/aggregate required for a specific condition.

The contractor will need to remove ponded or standing water from areas where water collects and prevent surface water runoff from reaching foundation excavations or the prepared subgrade for grade slabs. In addition, use designated haul routes for construction traffic and do not randomly traffic the site. Remove and replace disturbed subgrade soils with engineered fill. Under adverse weather conditions, protect areas of exposed subgrade at the site by placing crushed concrete or crushed aggregate on the exposed subgrade. In addition, place foundation concrete as soon as foundation excavations have been completed and approved to reduce the potential for disturbance of the foundation subgrade.

We recommend the bid documents require prospective contractors to include unit prices for removing unsuitable subgrade and replacing it with suitable engineered fill. Also, we recommend establishing a contingency in the construction budget for this work. The actual quantity of unsuitable soils onsite will vary, and can be significantly impacted by the contractor's means-and-methods (e.g. equipment and/or effort), time of year, variable subsurface conditions, etc. Actual undercut quantities must be determined during construction by additional subsurface evaluations in the field (e.g. test pits, proofrolls, hand auger probes, etc.). Verify actual undercut quantities during construction by measuring excavation volumes, counting truck loads, or a combination of methods.

Handling, transportation and disposal of excavated materials and groundwater should be performed in accordance with applicable regulatory requirements.

5. SIGNATURES

We appreciate the opportunity to work with you on this project. Please let us know if you have any questions and if we can assist you further with this project.

Report Prepared By:

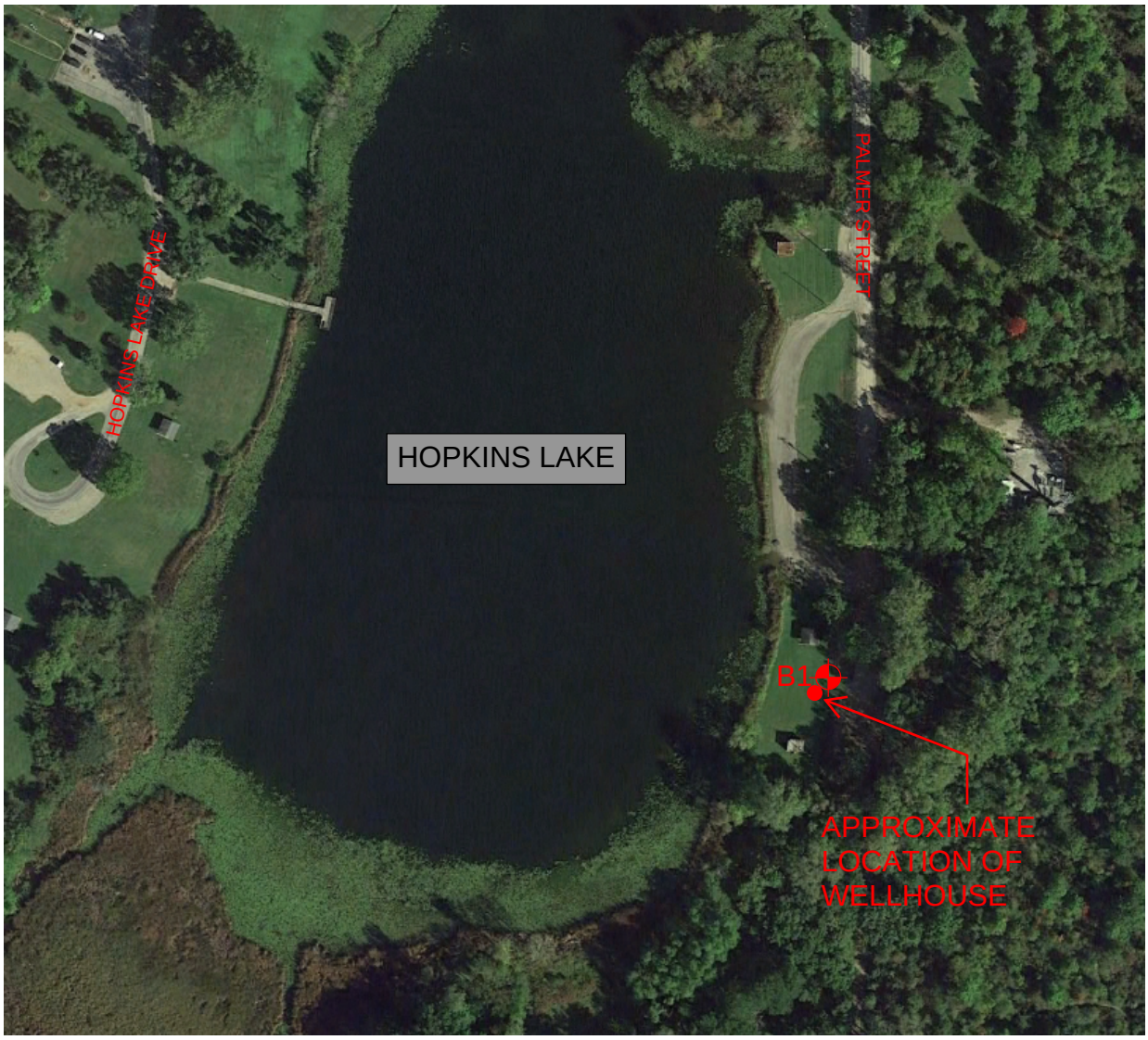
Logan S. Ross, EIT
Senior Staff Engineer

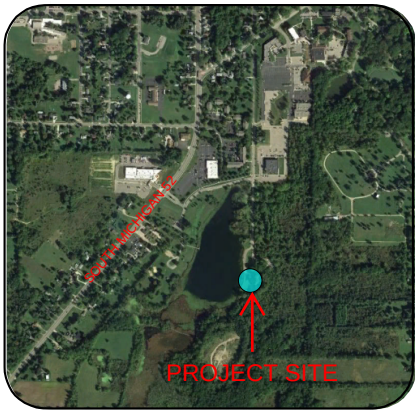
Report Reviewed By:

Andrew T. Bolton, PE
Senior Consultant
MI-6201057475

APPENDIX A

BORING LOCATION PLAN (FIGURE NO. 1)
BORING LOG TERMINOLOGY
BORING LOG (B1)





LOCATION MAP
NOT TO SCALE

NORTH

LEGEND

APPROXIMATE BORING LOCATION

NORTH

NOTE:
IMAGE INFORMATION TAKEN FROM GOOGLE EARTH
IMAGE DATE OF 09/21/2015

No.	Revision Date		
		Date	09/23/2022
		Drawn By	LSR
		Designed By	BLE
		Scale	NA
		Project	090304.00

BORING LOCATION DIAGRAM
PALMER 3A WELLHOUSE
1596-1636 PALMER STREET
OWOSSO, MICHIGAN

SME
www.sme-usa.com

Figure No. 1

BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)			
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)			
SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt Concrete, Glacial Till, Siltstone, Aggregate Base, Coal, Limestone, Portland Cement Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

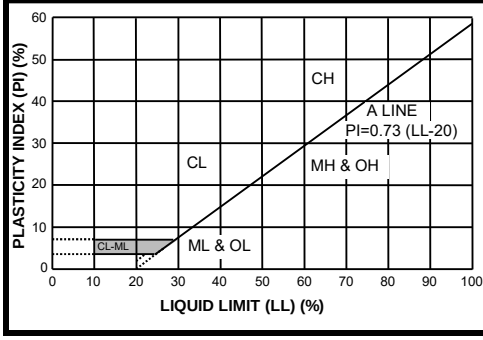
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressuremeter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES

The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:

Trace	–	particles are present but estimated to be less than 5%
Few	–	5 to 10%
Little	–	15 to 25%
Some	–	30 to 45%
Mostly	–	50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N_{60} (N-Value) (Blows per foot)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	Over 81

Cohesive Soils

Consistency	N_{60} (N-Value) (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	<2	0.25 or less
Soft	2 - 4	> 0.25 to 0.50
Medium	5 - 8	> 0.50 to 1.0
Stiff	9 - 15	> 1.0 to 2.0
Very Stiff	16 - 30	> 2.0 to 4.0
Hard	> 30	> 4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N60 values as reported on boring logs represent raw N-values corrected for hammer efficiency only.

10/4/22 8:54:40 AM

SME

BORING B 1

PAGE 1 OF 1

BORING DEPTH: 15 FEET

PROJECT NAME: Palmer 3A Wellhouse
PROJECT NUMBER: 090304.00
CLIENT: OHM Advisors
PROJECT LOCATION: Owosso, Michigan
DATE STARTED: 9/1/22
COMPLETED: 9/1/22
BORING METHOD: Solid-stem Augers
DRILLER: RM
RIG NO.: 531 (CME55LCX) - ATV
LOGGED BY: KJT
CHECKED BY: JSW

ELEVATION: 765.4 FT NAVD88

HAMMER EFFICIENCY: 83%
DATE: 3/10/2020
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%): PL, MC, LL (10, 20, 30, 40)

SHEAR STRENGTH (KSF) (1, 2, 3, 4): ▼ HAND PENE.; TORVANE SHEAR; UNC. COMP.; VANE SHEAR (PK); VANE SHEAR (REM); TRIAXIAL (UU)

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)
0.4	5 inches of TOPSOIL	765.0
3.0	FILL- Sandy LEAN CLAY- Frequent Clayey Sand Layers and Concrete Pieces- Brown- Very Stiff (CL)	762.4
11.5	Sandy LEAN CLAY- Brown- Very Stiff (CL)	753.9
15.0	Fine SAND with Silt- Brown- Moist- Medium Dense (SP-SM)	750.4
	END OF BORING AT 15.0 FEET.	

SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MOISTURE CONTENT (%)	HAND PENE. (KSF)	REMARKS
SB1	18	5-5-5	14	15	~4	
SB2	18	3-3-5	11	12	~3.25	
SB3	18	5-5-7	17	11	~4	
SB4	18	5-5-5	14	14	~3	
SB5	18	3-4-5	12			

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings & Bentonite Chips

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

APPENDIX B

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT
GENERAL COMMENTS
LABORATORY TESTING PROCEDURES

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110º C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440º C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

Passionate People Building
and Revitalizing our World

SME

GEOTECHNICAL EVALUATION REPORT

JUNIPER 1 WELLHOUSE
OWOSSO, MICHIGAN

SME Project 090315.00
October 10, 2022

October 10, 2022

Mr. Matt Kennedy, PE, LEED AP
OHM Advisors
34000 Plymouth Road
Livonia, Michigan 48150

Via E-mail: Matt.Kennedy@ohm-advisors.com

RE: Geotechnical Evaluation
Juniper 1 Wellhouse
Juniper Street
Owosso, Michigan
SME Project No. 090315.00

Dear Mr. Kennedy:

We have completed our geotechnical evaluation for the subject project. This report presents the results of our observations and analyses, our geotechnical recommendations, and general construction considerations based on the information disclosed by the borings.

We appreciate the opportunity to be of service. If you have questions or require additional information, please contact me.

Very truly yours,

SME

Bradford L Ewart II, PE
Project Manager / Senior Consultant
MI-6201060545

Enclosure: SME Geotechnical Evaluation Report; Dated October 10, 2022

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APPENDIX A

APPENDIX B

1. INTRODUCTION

This report presents the results of the geotechnical evaluation completed by SME for the subject project. We performed this evaluation in general accordance with the scope of services outlined in our proposal P02904.22, dated July 22, 2022; however, we performed one additional boring along the proposed watermain alignment. Our services for this evaluation were authorized OHM Advisors.

1.1 SITE CONDITIONS

The project site is located in Owosso, Michigan at the end of the Juniper Street two-track road approximately 1150 feet west of the residence at 739 North Hintz Road, and extends east to North Hintz Road. The approximate location of the proposed wellhouse and watermain are illustrated on the Boring Location Diagram (Figure No.1), included in Appendix A.

To the north and west of the project site is a residential development along Jackson Drive. Ponds and low-lying areas border the proposed development site to the north and south. The proposed development site currently consists of grass, brush, and tree covered areas. SME was not provided a topographic survey of the site. However, based on the ground surface elevations collected/estimated at the boring locations, the existing ground surface at the boring locations varies from an elevation of 742 to 745 feet.

1.2 PROJECT DESCRIPTION

Specific project details including site plan, topographic survey, grading plan, and structural loads have not been provided to SME. However, we understand the plan is to develop an approximate 300 square foot, single-story, slab-on-grade wellhouse that will be 15 feet by 20 feet on site situated over top of a water well, as well as a small exterior generator on a slab adjacent to the wellhouse. In addition, watermain is planned extending east from the wellhouse to North Hintz Road. The approximate location of the proposed wellhouse and proposed watermain alignment area illustrated on Figure No. 1.

While no detailed project information has been provided to SME, Mr. Andrew Vanwormer, PE of OHM Advisors informed SME that the foundation would be 42-inch block or poured wall on 24 inch spread footing based on a preliminary layout. Based on our experience with similar types of projects, we anticipate structural loads will include maximum column loads of 25 kips and maximum wall loads of 3 kips per linear foot. However, specific structural loading information has not been provided at the time of issuing this report. We assume cuts/fills to establish final grades will be 1-foot or less within the proposed development area. We understand the proposed watermain will be installed via open-cut methods and the invert will be 5 to 6 feet below existing grades.

1.3 PREVIOUS EVALUATIONS

SME previously performed a geotechnical evaluation for the proposed Osburn Lakes Residential Development Phase II in November of 2018 (SME Project No. 080282.00) and included two borings (B1 and B2) near the proposed watermain alignment. The approximate as-drilled locations of borings B1 and B2 are shown on Figure No. 1 and their boring logs are included in Appendix A.

The project team requested SME explore the subsurface conditions on the site and develop geotechnical recommendations for the proposed construction.

2. EVALUATION PROCEDURES

2.1 FIELD EXPLORATION

SME performed two borings (B1 and B2) at the site on September 1, 2022. The approximate as-drilled boring locations are shown on Figure No. 1.

SME and OHM Advisors jointly determined the number, proposed location, and depths of the borings. SME visited the site prior to drilling and staked the boring location and obtained the existing ground surface elevation at the boring location using our hand-held global positioning system (GPS) unit with sub-foot accuracy.

The borings were advanced with a rotary drill rig using continuous-flight augers. The borings included soil sampling based upon the Split-Barrel Sampling procedure. Portions of the recovered split-barrel samples were sealed in glass jars by the driller.

We measured and recorded groundwater depth (or lack thereof) during and immediately after completion of each boring. The driller backfilled the boreholes with the auger cuttings and bentonite chips at completion of drilling. We took the recovered soil samples to our laboratory for further observation and testing.

2.2 LABORATORY TESTING

The laboratory testing program consisted of visual soil classification on recovered samples in general accordance with ASTM D-2488 along with moisture content and hand penetrometer shear tests on portions of cohesive samples obtained. Based on the laboratory testing, we assigned a group symbol to the various soil strata encountered based on the Unified Soil Classification System (USCS). The Laboratory Testing Procedures in Appendix B provide descriptions of the laboratory tests given above.

Upon completion of the laboratory testing, we prepared boring logs including materials encountered, penetration resistances, pertinent field observations made during the drilling operations, and the results of certain laboratory tests. We developed the soil descriptions included on the boring logs from both visual classification and the results of laboratory tests. The boring logs also includes the existing ground surface elevation as estimated by SME. The boring logs are included in Appendix A. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet included in Appendix A.

Soil samples retained over a long time, even sealed in jars, are subject to moisture loss and are no longer representative of the conditions initially encountered in the field. Therefore, we retain soil samples in our laboratory for 60 days unless instructed otherwise.

3. SUBSURFACE CONDITIONS

3.1 SOIL CONDITIONS

The soil conditions encountered at borings B1, B2, B101, and B102 consist of surficial topsoil overlying natural clays with interbedded natural sands and silts extending to the explored boring depths. We provide a summary of the materials encountered at the boring locations, beginning at the existing ground surface and proceeding downward, below. Refer to the boring log for more detailed information.

Stratum 1: Topsoil. We encountered approximately 4 to 8 inches of topsoil at the surface of borings B1, B2, B101, and B102.

Stratum 2: Natural Clays with Interbedded Natural Sands and Silts. We encountered natural clays with interbedded natural sands and silts below the surficial topsoil at borings B1, B2, B101, and B102. Moisture contents of the clays varied from about 12 to 21 percent. Measured shear strengths varying from 1.5 to greater than 4.5 kips per square-foot (ksf) indicate the clays exhibited a stiff to hard consistency.

The soil profile described above and included on the boring logs are generalized descriptions of the conditions encountered. The stratification depths described above and shown on the boring logs indicate a zone of transition from one soil type to another and do not show exact depths of change from one soil type to another. We based the soil descriptions on visual classification of the soils encountered. Soil conditions may vary between or away from the boring locations. Please refer to the boring logs for the soil conditions at the specific boring location.

Thickness measurements of surficial materials reported on the boring logs (topsoil) need to be considered approximate since mixing of these materials can occur in small diameter boreholes. Therefore, if accurate thickness measurements are required for inclusion in bid documents or purposes of design, perform additional evaluations such as shallow test pits to more accurately measure the topsoil thickness.

3.2 GROUNDWATER CONDITIONS

We encountered groundwater at borings B1 and B101 during and at the completion of drilling at depths of 12.5 to 14 feet below the existing ground surface (corresponding to between approximate elevations 731 and 732.5 feet). Groundwater was not encountered in borings B2 and B102 that terminated between approximate elevations 732 and 733.3 feet.

In cohesive soils (clays and silts), a long time may be required for the groundwater level in the borehole to reach an equilibrium position. Therefore, the use of groundwater observation wells (piezometers) is necessary to accurately determine the hydrostatic groundwater level within cohesive soils as encountered at this site.

The groundwater levels and the potential rate of infiltration into excavations will fluctuate throughout the year based on variations in precipitation, evaporation and surface run-off. The groundwater levels indicated by the borings represent conditions at the time the readings were taken. The actual groundwater levels at the time of construction may vary. If more information regarding groundwater levels at this site is required, we recommend installing groundwater monitoring wells at the site.

4. ANALYSIS AND RECOMMENDATIONS

4.1 SITE PREPARATION AND EARTHWORK

4.1.1 SITE SUBGRADE PREPARATION

Within the proposed structure footprint, remove the surficial topsoil and existing structures such as sidewalks, pavements, slabs, foundations, etc. (if encountered) and other unsuitable materials. Where removing below-grade structures (if any), backfill the area with granular engineered fill to the final subgrade level. We recommend abandoned utilities be removed and backfilled with granular engineered fill to the design subgrade level. We recommend site clearing extend a minimum of 5 feet beyond the limits of the proposed improvement areas to ensure uniform support of proposed improvements. We recommend retaining SME to evaluate the subgrade and assist with determining where suitable soils are present during the site earthwork operations.

After stripping and removal of unsuitable materials, and after cutting to design subgrade levels, but before placing fill to raise grades, the exposed subgrade may need to be uniformly compacted using large construction equipment (depending on its condition). We recommend an SME field engineer be onsite to assist the earthwork contractor with evaluating the need for subgrade compaction. Take care during compaction not to damage nearby, existing structures. The type of compaction equipment will depend upon site-specific conditions and the proximity and sensitivity of existing structures. We recommend at least several passes be made with the compaction equipment. In some areas, moisture conditioning and/or undercutting may be necessary to enhance the effectiveness of the compaction operation. As with typical site earthwork projects in Michigan, it will be practical and economical to perform site earthwork activities and foundation/grade slab construction during the warmer, dryer summer months, when it is easier to perform moisture conditioning as needed.

After performing compactive efforts, and diverting perched groundwater from accumulating onsite, we recommend testing the subgrade for stability. Typically, such testing involves a proofroll with a large piece of construction equipment. Where areas are accessible for proofrolling, we recommend using a fully loaded tandem axle truck (50,000 ft-lbs. minimum) or similar piece of rubber tire equipment to perform the proofroll test. We recommend an SME representative be on-site to observe and document the subgrade reaction during the proofroll test and perform additional subgrade evaluation as necessary. Based on the results of the proofroll and other field tests, the SME representative can provide recommendations in the field regarding the suitability of the subgrade for structural support. Areas of unsuitably loose/wet/soft subgrade will need to be either improved in-place (e.g., dried and recompacted) or be removed (undercut) and replaced with engineered fill. Improvement of the exposed subgrade may consist of aerating and drying disturbed soils, recompacting these soils in-place, as well as placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation.

After making cuts or fills to design grades and after the exposed subgrade has been evaluated (as mentioned above) and improved as necessary, place engineered fill on the exposed subgrade to establish final subgrade levels. Refer to Section 4.1.3 for materials and compaction requirements for engineered fill.

4.1.2 SUBGRADE PREPARATION FOR FLOOR SLABS

We anticipate the final floor slab subgrade for the proposed building will consist of natural soils or engineered fill overlying by natural soils. These soils are considered suitable for support of floor slabs, provided the subgrade is prepared as described in Sections 4.1.1, and engineered fill is placed and compacted per Section 4.1.3. We recommend a subgrade modulus k (30) of 100 psi per inch be used to design floor slabs supported on properly prepared subgrade as described above. The recommend subgrade modulus k (30) is based on correlations with soil type developed from plate load tests conducted using a 30-inch diameter plate with 0.05-inches of deflection.

Prior to concrete placement for floor slabs, SME should observe and test the building pad subgrade to identify areas that were disturbed during construction activities and to verify the final subgrade conditions are suitable for floor slab support. Unsuitable subgrade identified by SME should be improved by compaction in place or removed and replaced with engineered fill. Final subgrade areas that are accessible with large equipment should be proofrolled, and areas inaccessible to proofrolling equipment should be evaluated with hand-operated equipment, such as cone penetrometers, hand auger probes, and density gauges.

The top 6 inches of the slab subbase should consist of an approved MDOT Class II granular material to provide a leveling surface for construction of the slab and a moisture capillary break between the slab and the underlying soils. MDOT 21AA dense-graded aggregate can be used as subbase material, instead of the Class II granular material, for improved stability and greater resistance to disturbance due to construction traffic. The thickness of dense-graded aggregate required to stabilize and protect the subgrade will depend on the condition of subgrade soils during construction and the type and volume of construction equipment to traffic the prepared subgrade. The leveling surface must be compacted per the "Engineered Fill Requirements" section of this report as discussed in Section 4.1.3.

A vapor retarder should be provided below floor slabs that are to receive an impermeable floor finish/seal or a floor covering which would retard vapor transmission. The location of the vapor retarder (relative to the subbase) should be determined by the design Architect/Engineer based on the intended floor usage, planned finishes, and ACI recommendations.

We recommend separating slabs by isolation joints from structural walls and columns to permit relative movement. A minimum of 6 inches of engineered fill should be placed between the bottom of the slab and the top of the shallow foundation below, to allow for relative settlements.

The slab-on-grade subgrade soils should be protected from frost action during winter construction. Frozen soils must be thawed and compacted or removed and replaced prior to slab-on-grade construction.

4.1.3 ENGINEERED FILL REQUIREMENTS

Fill placed within the construction area, including utility trench backfill, must be an approved material, free of frozen soil, organics, debris, particle sizes that will hinder compaction, and other deleterious materials. We recommend the fill be spread in level layers not exceeding 9 inches in loose thickness and be compacted to a minimum 95 percent of the maximum dry density as determined in accordance with the Modified Proctor Test. Thicker lifts of backfill may be acceptable, provided the type of compaction equipment can achieve the minimum compaction criterion throughout the entire thickness of the lift within the area of placement and with the type of backfill used. SME can provide recommendations in the field for adjusting lift thicknesses based on the specific type of compaction equipment/methods used during construction and verification the entire lift of fill is compacted to the project requirements. Sand fill should be compacted with a smooth-drum vibratory roller or vibratory plate compactors, including either walk-behind types or plate compactors mounted on a backhoe or excavator (i.e., a hoe-pac). Clay fill should be compacted by overlapping passes with a sheep's foot roller or other pneumatic tire type compaction equipment at a moisture content between the optimum and two percent below the optimum.

Minimal fill placement for general site grades are expected for this project. However, we believe the natural clay and sand soils are suitable for reuse as engineered fill (if needed for site grading), provided they meet the requirements listed in this section. We do not recommend silts for use as engineered fill. Granular fill is recommended for smaller backfill areas where large compaction equipment cannot operate. We recommend imported fill consist of MDOT Class II granular material.

The successful reuse of the on-site soils for engineered fill will depend on the time of year and the care the earthwork contractor uses during construction. During cold and wet periods of the year, the subgrade soils (in particular, soils containing significant silt and/or clay content) may become saturated and disturbed and the soils can be difficult to dry. If such conditions occur, the contractor may have to use more imported granular fill (sand) as engineered fill on the site.

For backfill in confined areas, and where drainage is required, we recommend using imported granular backfill such as MDOT Class II sand, MDOT 21AA crushed aggregate, and/or MDOT 6A crushed stone. The specific type of imported fill will depend on a variety of factors. For most instances, we anticipate MDOT Class II sand will be adequate. Crushed aggregate/stone would be necessary where the existing subgrade is in a wet condition and/or where site drainage is required. In addition to the use of crushed stone, it would likely be necessary to cap the stone with crushed aggregate or wrap the crushed stone with a heavy-duty non-woven geotextile fabric, to prevent the surrounding soils from infiltrating into the crushed stone.

For trenches and other excavations, we recommend the upper 18 inches of backfill consist of soils similar with the surrounding subgrade. The purpose for this is to limit mixing of different soil types near final subgrade levels.

4.2 OPEN CUT WATERMAIN INSTALLATIONS

4.2.1 EXCAVATION CONSIDERATIONS

Open-cut installation is planned for the proposed watermain. We recommend excavation sidewalls be adequately sloped back and/or braced to prevent sloughing and caving of sidewalls. In cases where instability occurs, it may be necessary to flatten slopes beyond what is required by MI-OSHA and/or utilize trench boxes in order to provide a stable excavation. Do not place stockpiled soils and/or operate construction equipment near excavations without providing bracing to resist the increased load along the edges of the excavations that could result in instability of the excavation slope.

Due to the anticipated lateral constraints of working near existing roadways at North Hintz Road and near the Osburn Drain #347, utilization of open-cut, sloped, and/or benched excavations may not be feasible at all locations. Therefore, we recommend that a temporary earth retention system (TERS) comprised of steel sheeting or appropriately sized steel trench boxes be used to support excavations where applicable. We recommend the design of TERS required during construction be provided by an experienced registered professional engineer and installed by a contractor experienced with this type of construction. Appropriate measures for providing temporary support of existing utilities and pavements will be required where the alignment excavations cross or are in close proximity to existing utilities or structures. Depending on the specific situations, monitoring of existing utilities during construction to identify any movements resulting from the proposed water main installation activities should be considered. Successful contractor(s) must submit earth retention design plans, as needed, which are prepared by licensed professional engineers experienced with those applications. SME can review contractor submittals, provide additional recommendations, and help the design team, as needed, if requested.

We generally expect sump pits and pumps will be suitable for controlling groundwater infiltration into shallow open-cut excavations. In areas where heavy infiltration occurs, multiple pumps may be needed. Due to the generally layered and/or low permeability clay profile, dewatering using wells or wellpoints may be impractical.

4.2.2 PIPE SUPPORT

We anticipate mostly suitable conditions consisting of natural clays or natural silts in at least a stiff condition will be encountered at the anticipated pipe invert depths for pipe support conditions. However, conditions may vary between boring locations. Undercutting of unsuitable soils could be necessary to provide suitable support if encountered.

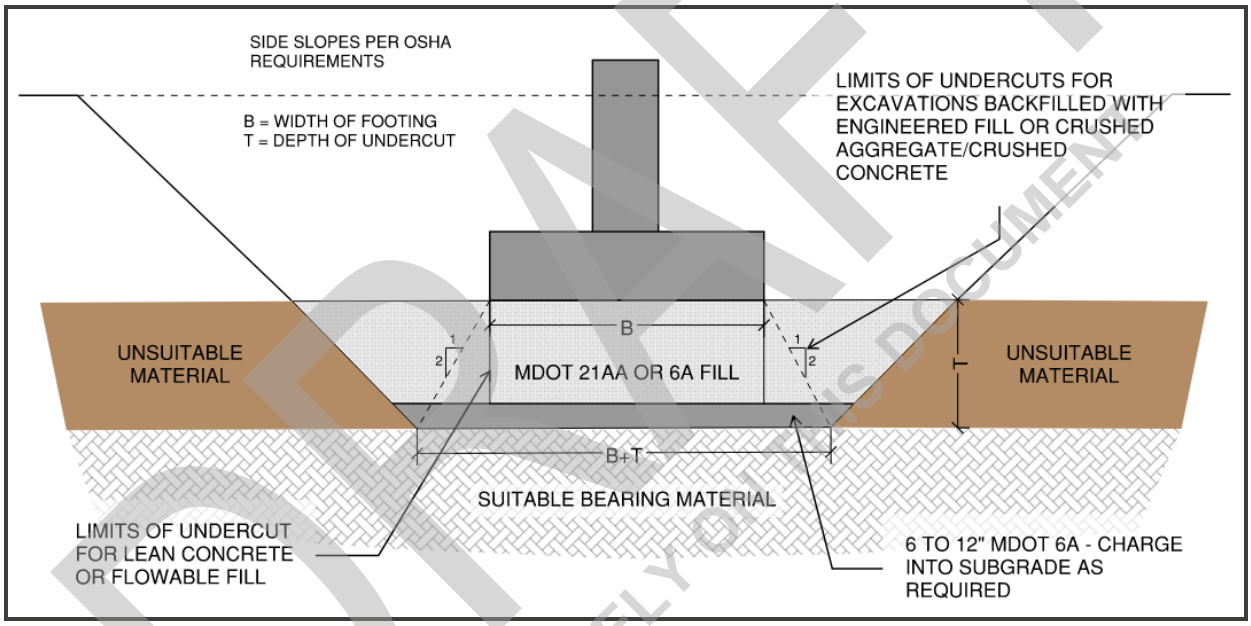
Undercut excavations to remove unsuitable soils should be properly oversized beneath utility pipes. Wet or disturbed soils must be undercut to encounter stable conditions and the undercut soils must be replaced with a layer of crushed aggregate or crushed concrete to provide a stable working surface. The required thickness of this stabilization layer will depend on the severity of the groundwater conditions and depth of weak soils. We recommend an SME representative be onsite during construction to further assess subsurface conditions and provide field recommendations for the stabilization layer.

We recommend bedding the new water main with an approved granular material meeting the requirements of the appropriate municipal agency. Where open-graded stabilization material is used, place a thin layer of dense-graded crushed aggregate/crushed concrete (such as MDOT 21AA) or a non-woven geotextile filter fabric over the open-graded material to reduce the risk of migration of sand bedding and backfill into the void spaces within the stabilization material. The placement and compaction of the bedding material should also conform to the requirements of the appropriate municipal agency and acceptable buried pipe design practices.

4.3 FOUNDATIONS

Shallow spread foundations are feasible for support of the equipment pad and wellhouse. We recommend designing the foundations for a maximum net allowable bearing pressure of 2,000 psf. Support the foundations on suitable natural soils or on engineered fill placed over suitable natural soils. While a higher soil bearing pressure is achievable in the very stiff to hard natural clays, we recommend limiting the design bearing pressure to reduce the potential for foundation undercuts if localized soft/disturbed zones are encountered. Also, due to the light structural loads expected, the spread foundation size(s) for the wellhouse will likely be governed by the size of the structure.

In areas where the exposed subgrade cannot attain the recommended soil bearing pressure, the foundation(s) could be re-designed at a reduced bearing pressure (requires input from the project structural engineer) or foundation undercutting would be required. Foundation undercuts can extend through any unsuitable subgrade until reaching suitable bearing soils. Alternatively, the undercut excavation could be backfilled with engineered fill so the foundation bears on engineered fill placed over suitable natural soils. Where oversizing is required, extend the undercut laterally on a two vertical to one horizontal slope from the outside edge of the foundation where undercutting and backfilling to the design bearing level. Please refer to the following Typical Foundation Undercutting Diagram:



Typical Foundation Undercutting Diagram

To verify suitable bearing soils are exposed and subgrade conditions are representative of those encountered at the borings, an SME representative needs be on site during foundation construction to observe and test the subgrade.

Foundations should be situated a minimum of 42 inches below final site grade in unheated areas for protection against frost action during normal winters. It is unknown if the wellhouse will not be climate controlled (i.e. open structures exposed to variable weather conditions), therefore we recommend interior foundations should be situated a minimum of 42 inches below final site grades for protection against frost action during normal winters.

Trenched foundations through the very stiff to hard natural clays appear feasible. For trench foundation construction, we recommend the foundation sidewalls be shaped in a vertical manner and not be allowed to 'mushroom out' near the top. If side-wall caving occurs, remove the sloughed soils and re-establish an undisturbed bearing surface.

For bearing capacity and settlement considerations, we recommend continuous (wall) foundations have a minimum width of 18 inches. In some cases where there are relatively light structural loads, the minimum foundation size criteria may dictate the size of the foundation and not the allowable soil bearing pressure.

We estimate total settlement for shallow foundations using the recommended design soil bearing pressure and bearing on suitable soils as described above to be less than 1 inch. We base the settlement estimates on the available soil borings, the estimated structural loads, our experience with similar structures and soil conditions and field verification of suitable bearing soils by SME.

4.4 SEISMIC SITE CLASS

The site (wellhouse-B1) is located at the approximate geographic location latitude N43.0084 degrees and longitude W84.1536 degrees. From available topographical information available for purposes of identifying the depth to bedrock, the approximate ground surface elevation at the proposed site is 745 feet. Based on Plate 13 (Topography of the Bedrock Surface) in the Hydrogeologic Atlas of Michigan, the top of rock elevation is around 680 feet in the vicinity of the site. Based on the above information, the glacial drift is roughly 65 feet thick.

The known shear strength and N-values for drift at this site are limited to the explored depth of about 15 feet below the ground surface at the borings drilled for this evaluation, which we anticipate to be of similar or better strength with increasing depth (based on deeper soil data provided in the Water Well Record). Based on the referenced soil conditions, averaged over the upper 100 feet of the profile, Seismic Site Class D applies to this site in accordance with the 2015 Michigan Building Code (MBC) referencing Table 20.3-1 in ASCE Standard ASCE/SEI 7-16.

4.5 CONSTRUCTION CONSIDERATIONS

Groundwater seepage into shallow foundation and utility excavations is generally not anticipated to be a significant factor during construction. However, some accumulation from precipitation events, surface run-off or seepage from perched groundwater sources could be encountered. We anticipate standard sump pit and pumping procedures should generally be adequate to control these accumulations, on a localized basis. A working surface of either crushed aggregate or crushed concrete may be required to protect the exposed subgrade where seepage is encountered.

The subgrade soils at this site will be sensitive to disturbance when trafficked, especially when these soils become wet. If the subgrade is disturbed, it will be necessary to disc, aerate, and recompact the disturbed soils, or to remove and replace the disturbed soils with engineered fill, crushed aggregate, or crushed concrete. To protect areas of prepared subgrade from disturbance, and to create dependable haul routes and material laydown areas, placement of crushed aggregate or crushed concrete, possibly with a geotextile for separation, could be required.

Remove ponded surface water and prevent run-off from reaching foundation excavations and areas of prepared subgrade. Establish positive surface drainage at the onset of construction to mitigate the potential for subgrade disturbance. To reduce the potential of subgrade disturbance across the site, construction traffic should be restricted to dedicated areas of the site, and not be allowed to randomly traffic the entire site.

If seepage into excavations occurs (from perched groundwater, surface run-off, precipitation, or other factors), we believe it can be controlled using standard sump pit and pumping procedures on a localized basis. In excavation areas where seepage accumulates, a working surface of either crushed aggregate or crushed concrete may be required to protect the exposed surface from disturbance. SME can provide recommendations in the field regarding the thickness (and type) of crushed stone/aggregate required for a specific condition.

Handling, transportation and disposal of excavated materials and groundwater should be performed in accordance with applicable regulatory requirements.

5. SIGNATURES

We appreciate the opportunity to work with you on this project. Please let us know if you have any questions and if we can assist you further with this project.

REPORT PREPARED BY:

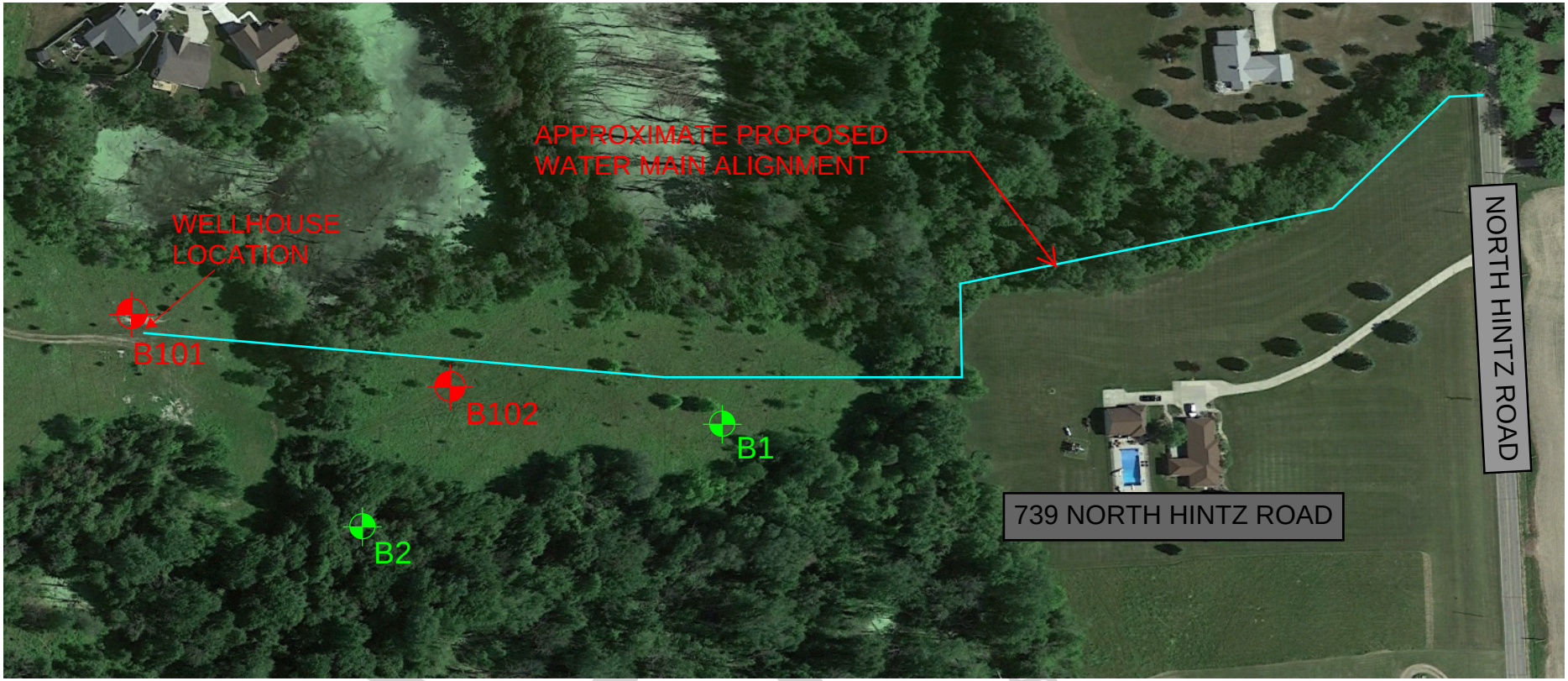
Logan S. Ross, EIT
Senior Staff Engineer

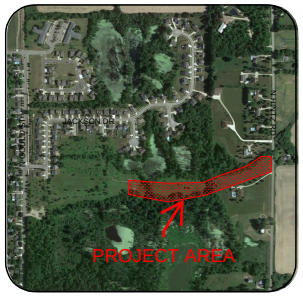
REPORT REVIEWED BY:

Andrew T. Bolton, PE
Senior Consultant
MI-6201057475

APPENDIX A

BORING LOCATION PLAN (FIGURE NO. 1)
BORING LOG TERMINOLOGY
2022 BORING LOGS (B101 AND B102)
2018 BORING LOGS (B1 AND B2) FROM SME PROJECT NO. 080282.00 DATED NOVEMBER 29, 2018





LOCATION MAP

NOT TO SCALE

LEGEND

NORTH

APPROXIMATE BORING LOCATION

APPROXIMATE BORING LOCATION
(2018, SME PROJECT NO. 080282.00)

NOTE:
DRAWING INFORMATION TAKEN FROM A PDF OF A DRAWING TITLED "JUNIPER WELL WATER MAIN SKETCH" WITH GOOGLE EARTH BACKGROUND
LATEST ISSUE DATE OF 02-21-2022, PREPARED BY SHIAWASSEE GIS AND OHM ADVISORS.

No.	Revision Date		
		Date	09/28/2022
		Drawn By	LSR
		Designed By	BLE
		Scale	N/A
		Project	090315.00

BORING LOCATION DIAGRAM
JUNIPER 1 WELLHOUSE
JUNIPER STREET (TWO-TRACK ROAD)
OWOSSO, MICHIGAN

SME
www.sme-usa.com

Figure No. 1

BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL
(more than 50% of material is larger than No. 200 sieve size.)

GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures

FINE-GRAINED SOIL
(50% or more of material is smaller than No. 200 sieve size)

SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt Concrete, Glacial Till, Siltstone, Aggregate Base, Coal, Limestone, Portland Cement Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

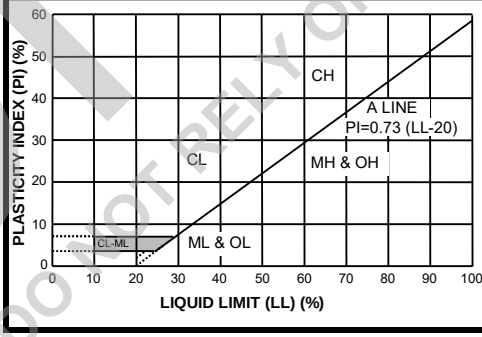
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressuremeter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES

The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:

Trace	–	particles are present but estimated to be less than 5%
Few	–	5 to 10%
Little	–	15 to 25%
Some	–	30 to 45%
Mostly	–	50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N_{60} (N-Value) (Blows per foot)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	Over 81

Cohesive Soils

Consistency	N_{60} (N-Value) (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	<2	0.25 or less
Soft	2 - 4	> 0.25 to 0.50
Medium	5 - 8	> 0.50 to 1.0
Stiff	9 - 15	> 1.0 to 2.0
Very Stiff	16 - 30	> 2.0 to 4.0
Hard	> 30	> 4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N60 values as reported on boring logs represent raw N-values corrected for hammer efficiency only.

10/7/22 11:52:17 AM

BORING B 101

BORING DEPTH: 15 FEET

PROJECT NAME: Juniper 1 Wellhouse
PROJECT NUMBER: 090315.00
CLIENT: OHM Advisors
PROJECT LOCATION: Owosso, Michigan

DATE STARTED: 9/1/22 **COMPLETED:** 9/1/22 **BORING METHOD:** Solid-stem Augers
DRILLER: RM **RIG NO.:** 531 (CME55LCX) - ATV **LOGGED BY:** KJT **CHECKED BY:** JSW

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION (ELEVATION: 745 FT (NAVD 88))	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	REMARKS
745	0	0.3 4 inches of TOPSOIL — 744.7				
		LEAN CLAY with Sand- Frequent Silt Seams- Brown and Gray- Very Stiff (CL)	SB1	18	4 5 6	
		3.0 — 742.0				
			SB2	18	6 8 18	
740	5	Sandy LEAN CLAY- Brown- Hard (CL)				
			SB3	18	5 8 11	
		8.0 — 737.0				
			SB4	18	6 9 9	
735	10	LEAN CLAY- Gray- Hard (CL)				
		12.5 — 732.5				
		Fine to Coarse SAND with Silt- Gray- Wet- Medium Dense (SP-SM)	SB5	18	5 6 6	
730	15	15.0 — 730.0				
		END OF BORING AT 15.0 FEET.				
725	20					
720	25					
715	30					

HAMMER EFFICIENCY: 83%
DATE: 3/10/2020
N_{60} -- ○
10 20 30 40
15 36 26 25 17

DRY DENSITY (pcf) -- ■
90 100 110 120
MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40
12 13 14 19

▽ HAND PENE.
⊠ TORVANE SHEAR
● UNC. COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
SHEAR STRENGTH (KSF)
1 2 3 4
4.5+ 4.5+ 4.5+

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	12.5	732.5
▼ AT END OF BORING:	12.5	732.5

BACKFILL METHOD: Auger Cuttings & Bentonite Chips

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

10/7/22 11:52:18 AM

BORING B 102

BORING DEPTH: 10 FEET

PROJECT NAME: Juniper 1 Wellhouse
PROJECT NUMBER: 090315.00
CLIENT: OHM Advisors
PROJECT LOCATION: Owosso, Michigan

DATE STARTED: 9/1/22 **COMPLETED:** 9/1/22 **BORING METHOD:** Solid-stem Augers
DRILLER: RM **RIG NO.:** 531 (CME55LCX) - ATV **LOGGED BY:** KJT **CHECKED BY:** JSW

ELEVATION: 743.3 FT (NAVD 88)

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES
0					
0.5	6 inches of TOPSOIL	742.8			
	LEAN CLAY with Sand- Brown and Gray- Very Stiff (CL)		SB1	18	3 3 3
2.5		740.8			
3.5	Fine to Medium SILTY SAND- Brown- Moist (SM)	739.8			
			SB2	18	3 6 8
	Sandy LEAN CLAY- Brown to Gray at 8 feet- Hard (CL)		SB3	18	6 10 10
			SB4	18	8 10 14
10.0		733.3			
10	END OF BORING AT 10.0 FEET.				
15					
20					
25					
30					

HAMMER EFFICIENCY: 83%
DATE: 3/10/2020
N_{60} -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

SHEAR STRENGTH (KSF)
▽ HAND PENE.
⊠ TORVANE SHEAR
● UNC. COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings & Bentonite Chips

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

BORING B1

PROJECT NAME: Osburn Lakes Residential Development - Phase II **PROJECT NUMBER:** 080282.00

CLIENT: City of Owosso **PROJECT LOCATION:** Owosso, Michigan

DATE STARTED: 11/9/18 **COMPLETED:** 11/9/18 **BORING METHOD:** Solid-stem Augers

DRILLER: RM/KD **RIG NO.:** 531 CME 55 LCX-ATV **LOGGED BY:** JAR **CHECKED BY:** JSW

SURFACE ELEVATION: 745± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION		SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE -- ○
745	0	0.5	6 inches of TOPSOIL	744.5			
			Sandy LEAN CLAY- Brown and Gray- Stiff (CL)	SB1	18	3 3 6	9
		4.0		741.0			
740	5		CLAYEY SILT- Brown and Gray- Stiff (ML)	SB2	18	4 5 7	12
		6.0		739.0			
			LEAN CLAY- Gray and Brown- Hard (CL)	SB3	18	5 5 11	16
735	10			SB4	18	11 16 20	36
		12.0		733.0			
			LEAN CLAY- Sand Layer at 14 feet- Gray- Stiff (CL)	SB5	18	6 3 6	9
730	15	15.0		730.0			
			END OF BORING AT 15.0 FEET.				
725	20						

DRY DENSITY (pcf) -- ■	MOISTURE & ATTERBERG LIMITS (%)	SHEAR STRENGTH (KSF)	REMARKS
90 100 110 120	PL MC LL; 10 20 30 40	▽ HAND PENE. ⊠ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) × VANE SHEAR (REM) ◈ TRIAXIAL (UU); 1 2 3 4	
	20	▽	
	17	▽	
	14	4.5+ ▽	
	14	4.5+ ▽	
	18	▽	

GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ **DURING BORING:**	14.0	731.0
▼ **AT END OF BORING:**	14.0	731.0

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

BORING B2

PROJECT NAME: Osburn Lakes Residential Development - Phase II **PROJECT NUMBER:** 080282.00

CLIENT: City of Owosso **PROJECT LOCATION:** Owosso, Michigan

DATE STARTED: 11/9/18 **COMPLETED:** 11/9/18 **BORING METHOD:** Solid-stem Augers

DRILLER: RM/KD **RIG NO.:** 531 CME 55 LCX-ATV **LOGGED BY:** JAR **CHECKED BY:** JSW

SURFACE ELEVATION: 742± FT

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	BLOWS PER SIX INCHES	N-VALUE -- ○ (10 20 30 40)	DRY DENSITY (pcf) -- ■ (90 100 110 120); MOISTURE & ATTERBERG LIMITS (%) PL MC LL (10 20 30 40)	▽ HAND PENE. ☒ TORVANE SHEAR ○ UNC.COMP. ⊡ VANE SHEAR (PK) ⨯ VANE SHEAR (REM) ◈ TRIAXIAL (UU) SHEAR STRENGTH (KSF) (1 2 3 4)	REMARKS
741.3	0	0.7 8 inches of TOPSOIL							
740		LEAN CLAY- Occasional Roots- Brown and Gray- Stiff (CL)	SB1	18	3 4 6	10	17	▽	
738.5	3.5								
			SB2	18	6 9 11	20	14	4.5+ ▽	
735	5	LEAN CLAY with Sand- Brown and Gray- Hard (CL)	SB3	18	5 8 13	21	14	4.5+ ▽	
732.0	10.0		SB4	18	8 10 15	25	13	4.5+ ▽	
	10	END OF BORING AT 10.0 FEET.							
730									
	15								
725									
	20								

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings

NOTES: 1. The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

APPENDIX B

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT
GENERAL COMMENTS
LABORATORY TESTING PROCEDURES

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept*

responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are not final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110º C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for 4 hours in a muffle furnace at a high temperature (approximately 440º C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a ½-inch thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool ½ inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

DOCUMENT 00 31 43 - PERMITS

1.1 PERMIT APPLICATION INFORMATION

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of the Bidders' own investigations. This Document and its attachments are not part of the Contract Documents.

B. Palmer 3A Project:
   1. EGLE Part 399 Permit for Construction of Water Supply Systems. The construction permit for Project is expected to be issued by EGLE in DECEMBER 2022. A copy of the Permit will be available upon request.
   2. City of Owosso Building Department. The contract documents have been submitted for review. The Contractor to apply for the permit for the Project.
   3. Shiawassee County Health Department for Soil Erosion and Sediment Control permit. Permit application number unknown at time of bidding. The Contractor is responsible for obtaining a soil erosion and sedimentation control permit as part of the proposed work.

C. Juniper Project:
   1. EGLE Part 399 Permit for Construction of Water Supply Systems. The construction permit for Project is expected to be issued by EGLE in DECEMBER 2022. A copy of the Permit will be available upon request.
   2. EGLE/USACE Joint Permit. The construction permit for Project is expected to be issued by EGLE in DECEMBER 2022. A copy of the Permit will be available upon request.
   3. Shiawassee County Drain Commissioner for Utility Crossing under Osburn Drain. The construction permit for Project has been issued by the Shiawassee County Drain Commissioner [11/03/2022]. A copy of the Permit is available upon request.
   4. City of Owosso Building Department. The contract documents have been submitted for review. The Contractor to apply for the permit for the Project.
   5. Shiawassee County Health Department for Soil Erosion and Sediment Control permit. Permit application number unknown at time of bidding. The Contractor is responsible for obtaining a soil erosion and sedimentation control permit as part of the proposed work.

END OF DOCUMENT 00 31 43

SECTION 00 43 13 - BID BOND

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

BIDDER (Name and Address):

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

OWNER (Name and Address):
City of Owosso
301 W. Main Street
Owosso, Michigan 48867

BID
Bid Due Date: January 17, 2023
Palmer 3A Project Description: The Project consists of demolition of the existing Palmer 3 wellhouse, abandonment of Palmer 3 well, abandonment of 150 feet of water main; installation of one wellhouse, one vertical line-shaft turbine pump and 71 feet of water main, installation of a gas-powered generator and two automatic transfer switches.
Juniper Project Description: The Project consists of installation of one wellhouse, one vertical line-shaft turbine pump and 1,544 feet of water main: 1,460 feet of 12-inch water main directionally drilled and 84 feet of 12-inch water main open cut. Installation of a gas-powered generator.

BOND
Bond Number:
Date:
Penal sum _____ $ _____
(Words) (Figures)

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

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

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

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:
    a. 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
    b. All Bids are rejected by Owner, or
    c. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions shall not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION 00 44 36 – SUBCONTRACTOR, SUPPLIER LISTING

Bidder submits to use the following subcontractors and/or suppliers for performance of the work in accordance with Article 12 of the Instructions to Bidders. This form will be submitted to the Engineer within 24 hours of the Bid Opening date and time from the lowest three (3) Bidders. Failure to supply this information may be cause for rejection of Bid.

A. The following companies shall execute subcontracts for the portions of the Work indicated:

1. Concrete Work: _____

2. Masonry Work: _____

3. Roof Work: _____

4. Painting Work: _____

5. Well and Well Pump Work (Check one)
   a. Peerless Midwest, Inc. ( )
   b. Northern Pump & Well, Inc. ( )
   c. Raymer Water Supply Contractors ( )
   d. Other (MUST BE PRE-APPROVED BY ENGINEER):

   _____

6. Mechanical/Process/Plumbing Work: _____

7. Electrical Work: _____

8. Demolition Work: _____

B. The following manufacturers shall execute subcontracts for the supply of the proposed major equipment components of the Work indicated:

1. Well Pump Manufacturer: _____

2. Generator Manufacturer: _____

SECTION 00 45 10 - QUALIFICATIONS STATEMENT

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

1. SUBMITTED BY:

Official Name of Firm: _____

Address: _____

_____

_____

2. SUBMITTED TO: _____

3. SUBMITTED FOR: _____

Owner: _____

Project Name: _____

_____

_____

TYPE OF WORK: _____

_____

_____

4. CONTRACTOR'S CONTACT INFORMATION

Contact Person: _____

Title: _____

Phone: _____

Email: _____

5. AFFILIATED COMPANIES:

Name: _____

Address: _____

_____

_____

6. TYPE OF ORGANIZATION:

☐ SOLE PROPRIETORSHIP

Name of Owner: _____

Doing Business As: _____

Date of Organization: _____

☐ PARTNERSHIP

Date of Organization: _____

Type of Partnership: _____

Name of General Partner(s): _____

_____

_____

☐ CORPORATION

State of Organization: _____

Date of Organization: _____

Executive Officers:

- President: _____

- Vice President(s): _____

_____

_____

- Treasurer: _____

- Secretary: _____

☐ LIMITED LIABILITY COMPANY

State of Organization: _____

Date of Organization: _____

Members: _____

_____

_____

_____

☐ JOINT VENTURE

Sate of Organization: _____

Date of Organization: _____

Form of Organization: _____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

_____

Joint Venture Managing Partner

- Name: _____

- Address: _____

_____

Joint Venture Managing Partner

- Name: _____

- Address: _____

7. LICENSING

Jurisdiction: _____

Type of License: _____

License Number: _____

Jurisdiction: _____

Type of License: _____

License Number: _____

8. CERTIFICATIONS

CERTIFIED BY:

Disadvantage Business Enterprise: _____

Minority Business Enterprise: _____

Woman Owned Enterprise: _____

Small Business Enterprise: _____

Other (_____): _____

9. BONDING INFORMATION

Bonding Company: _____

Address: _____

_____

Bonding Agent: _____

Address: _____

_____

_____

Contact Name: _____

Phone: _____

Aggregate Bonding Capacity: _____

Available Bonding Capacity as of date of this submittal: _____

10. FINANCIAL INFORMATION

Financial Institution: _____

Address: _____

_____

Account Manager: _____

Phone: _____

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

11. CONSTRUCTION EXPERIENCE:

Current Experience:

List on **Schedule A** all uncompleted projects currently under contract (If Joint Venture list each participant's projects separately).

Previous Experience:

List on **Schedule B** all projects completed within the last 5 Years (If Joint Venture list each participant's projects separately).

Has firm listed in Section 1 ever failed to complete a construction contract awarded to it?

☐ YES ☐ NO

If YES, attach as an Attachment details including Project Owner's contact information.

Has any Corporate Officer, Partner, Joint Venture participant or Proprietor ever failed to complete a construction contract awarded to them in their name or when acting as a principal of another entity?

☐ YES ☐ NO

If YES, attach as an Attachment details including Project Owner's contact information.

Are there any judgments, claims, disputes or litigation pending or outstanding involving the firm listed in Section 1 or any of its officers (or any of its partners if a partnership or any of the individual entities if a joint venture)?

☐ YES ☐ NO

If YES, attach as an Attachment details including Project Owner's contact information.

12. SAFETY PROGRAM:

Name of Contractor's Safety Officer:_____

Include the following as attachments:

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) OSHA No. 500- Log & Summary of Occupational Injuries & Illnesses for the past 5 years.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all OSHA Citations & Notifications of Penalty (monetary or other) received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide as an Attachment Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) list of all safety citations or violations under any state all received within the last 5 years (indicate disposition as applicable) - IF NONE SO STATE.

Provide the following for the firm listed in Section V (and for each proposed Subcontractor furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) the following (attach additional sheets as necessary):

Workers' compensation Experience Modification Rate (EMR) for the last 5 years:

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

Total Recordable Frequency Rate (TRFR) for the last 5 years:

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

Total number of man-hours worked for the last 5 Years:

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

Provide Contractor's (and Contractor's proposed Subcontractors and Suppliers furnishing or performing Work having a value in excess of 10 percent of the total amount of the Bid) Days Away From Work, Days of Restricted Work Activity or Job Transfer (DART) incidence rate for the particular industry or type of Work to be performed by Contractor and each of Contractor's proposed Subcontractors and Suppliers) for the last 5 years:

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

13. EQUIPMENT:

MAJOR EQUIPMENT:

List on **Schedule C** all pieces of major equipment available for use on Owner's Project.

I HEREBY CERTIFY THAT THE INFORMATION SUBMITTED HEREWITH, INCLUDING ANY ATTACHMENTS, IS TRUE TO THE BEST OF MY KNOWLEDGE AND BELIEF.

NAME OF ORGANIZATION: _____

BY: _____

TITLE: _____

DATED: _____

NOTARY ATTEST:

SUBSCRIBED AND SWORN TO BEFORE ME

THIS _____ DAY OF _____, 20___

NOTARY PUBLIC - STATE OF _____

MY COMMISSION EXPIRES:_____

REQUIRED ATTACHMENTS

1. Schedule A (Current Experience).
2. Schedule B (Previous Experience).
3. Schedule C (Major Equipment).
4. Audited balance sheet for each of the last 3 years for firm named in Section 1.
5. Evidence of authority for individuals listed in Section 7 to bind organization to an agreement.
6. Resumes of officers and key individuals (including Safety Officer) of firm named in Section 1.
7. Required safety program submittals listed in Section 13.
8. Equipment Data Sheets as required.
9. Additional items as pertinent.

SCHEDULE A

CURRENT EXPERIENCE

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

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

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

SCHEDULE B

PREVIOUS EXPERIENCE (Include ALL Projects Completed within last 5 years)

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

SCHEDULE C - LIST OF MAJOR EQUIPMENT AVAILABLE

ITEM	PURCHASE DATE	CONDITION	ACQUIRED VALUE

SECTION 00 45 14 - IRAN LINKED BUSINESS CERTIFICATION

Pursuant to Michigan Public Act 517 of 2012, any Bidder that submits a bid on a request for proposal with City of Owosso shall certify that Bidder is not an Iran linked business. An Iran linked business is not eligible to submit a bid on a request for proposal with City of Owosso. See attached definitions regarding this certification.

The undersigned Bidder does hereby certify, pursuant to Michigan Public Act 517 of 2012, that:

Bidder is not a person engaging in investment activities in the energy sector of Iran, including a person that provides oil or liquefied natural gas tankers, or products used to construct or maintain pipelines used to transport oil or liquefied natural gas, for the energy sector of Iran, or

Bidder is not a financial institution that extends credit to another person if that person will use the credit to engage in investment activities in the energy sector of Iran.

Date: _____ _____

By: _____

Its: _____

Subscribed and sworn to before me, a Notary Public on this ____day of _____ ,

Notary Public _____

_____ County, Michigan

My Commission Expires: _____

DEFINITIONS

(A) "Energy sector of Iran" means activities to develop petroleum or natural gas resources or nuclear power in Iran.

(B) "Investment" means 1 or more of the following:
   i. A commitment or contribution of funds or property.
   ii. A loan or other extension of credit.
   iii. The entry into or renewal of a contract for goods or services.

(C) "Investment activity" means 1 or more of the following:
   i. A person who has an investment of $20,000,000.00 or more in the energy sector of Iran.
   ii. A financial institution that exceeds $20,000,000.00 or more in credit to another person, for 45 days or more, if that person will use the credit for investment in the energy sector of Iran.

(D) "Iran" means any agency or instrumentality of Iran.

(E) "Iran linked business" means either of the following:
   i. A person engaging in investment activities in the energy sector of Iran, including a person that provides oil or liquefied natural gas tankers or products used to construct or maintain pipelines used to transport oil or liquefied natural gas for the energy sector of Iran.
   ii. A financial institution that extends credit to another person, if that person will use the credit to engage in investment activities in the energy sector of Iran.

(F) "Person" means any of the following:
   i. An individual, corporation, company, limited liability company, business association, partnership, society, trust, or any other nongovernmental entity, organization, or group.
   ii. Any governmental entity or instrumentality of a government, including a multilateral development institution, as defined in section 1701(c) (3) of the international financial institutional act, 22 USC 262r(c) (3).
   iii. Any successor, subunit, parent company, or subsidiary of, or company under common ownership or control with, any entity described in subparagraph (i) or (ii).

(G) "Public entity" means this state or an agency or authority of this state, school district, community college district, intermediate school district, city, village, township, county, public authority, or public airport authority.

MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY

Finance Division

NON-EQUIVALENCY PROJECTS CONTRACT BOILERPLATE LANGUAGE

Instructions:
The following is the required standard contract language that must appear in bidding documents of Clean Water State Revolving Fund and Drinking Water State Revolving Fund non-equivalency projects. Determination of equivalent vs. non-equivalent projects is made on a yearly basis as indicated in the Intended Use Plan (IUP) and will be communicated by your EGLE project manager. If you are unsure whether your project is equivalent, consult with your EGLE project manager.

- **American Iron & Steel Contract Language**
- **Davis-Bacon and Related Acts/Prevailing Federal Wages**
- **Labor Standards Provisions for Federally Assisted Projects**
- **Certification Regarding Debarment, Suspension, and Other Responsibility Matters*****

***Bidders should note this section contains instructions regarding forms/information that must be completed and included with any submitted bid.

American Iron and Steel Contract Language

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.

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: MI20220151 08/26/2022

Superseded General Decision Number: MI20210151

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)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $15.00 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 2022.
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 $11.25 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 2022.

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 https://www.dol.gov/agencies/whd/government-contracts.

Modification Number	Publication Date
0	01/07/2022
1	02/18/2022
2	02/25/2022
3	04/08/2022
4	05/20/2022
5	06/03/2022
6	06/24/2022
7	07/15/2022
8	07/29/2022
9	08/05/2022
10	08/26/2022

ASBE0047-005 07/01/2022

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR	$ 34.62	18.58

BOIL0169-002 01/01/2021

	Rates	Fringes
BOILERMAKER	$ 35.95	34.52

BRMI0009-011 08/01/2020

	Rates	Fringes
BRICKLAYER	$ 33.23	23.08
PLASTERER	$ 30.34	20.43
TILE SETTER	$ 29.93	18.02

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 06/01/2021

	Rates	Fringes
CARPENTER (Excluding Acoustical Ceiling Installation, Drywall Hanging, Form Work, Metal Stud Installation, and Soft Floor Layer - Carpet)	$ 29.48	22.00

CARP0706-024 06/01/2021

	Rates	Fringes
CARPENTER (Acoustical Ceiling Installation, Drywall Hanging, Form Work, and Metal Stud Installation)	$ 29.48	22.00

CARP1102-003 06/01/2020

	Rates	Fringes
MILLWRIGHT	$ 35.50	34.10

ENGI0324-022 06/01/2022

	Rates	Fringes
OPERATOR: Power Equipment		
GROUP 1	$ 44.13	24.85
GROUP 2	$ 40.83	24.85
GROUP 3	$ 38.18	24.85
GROUP 4	$ 36.47	24.85
GROUP 5	$ 30.61	24.85
GROUP 6	$ 28.13	24.85

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 06/01/2022

	Rates	Fringes
IRONWORKER, STRUCTURAL (Metal Building Erection Only)	$ 34.50	30.76

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* IRON0025-010 06/01/2022

	Rates	Fringes
IRONWORKER, REINFORCING	$ 31.43	28.17
IRONWORKER, STRUCTURAL	$ 27.43	28.17

LABO1075-012 06/01/2022

	Rates	Fringes
LABORER		
Common or General; Mason Tender - Brick; Mason Tender - Cement/Concrete; Pipelayer; and Sandblaster	$ 26.41	14.05

PAIN1052-001 05/01/2022

	Rates	Fringes
PAINTER		
Brush & Roler	$ 27.87	14.15
Spray	$ 29.22	14.15

PAIN1052-004 06/01/2020

	Rates	Fringes
DRYWALL FINISHER/TAPER		
Drywall sanding	$ 27.15	15.00
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 06/01/2022

	Rates	Fringes
PIPEFITTER (Includes HVAC Pipe Installation & Excludes HVAC System Installation)	$ 42.21	22.35
PLUMBER (Excludes HVAC Pipe & System Installation)	$ 42.21	22.35

SFMI0669-003 04/02/2022

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers)	$ 38.69	24.66

SHEE0007-011 05/01/2018

	Rates	Fringes
SHEET METAL WORKER (Incldуing HVAC Duct & System Installation)	$ 30.64	22.76

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* 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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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($15.00) or 13658 ($11.25). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage

determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those

classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

"General Decision Number: MI20220044 09/23/2022

Superseded General Decision Number: MI20210044

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)(2)-(60).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	. Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $15.00 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 2022.
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 $11.25 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 2022.

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 https://www.dol.gov/agencies/whd/government-contracts.

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0	01/07/2022
1	02/25/2022
2	06/24/2022
3	07/01/2022
4	07/08/2022
5	07/15/2022
6	08/05/2022
7	08/12/2022
8	09/16/2022
9	09/23/2022

CARP0100-005 06/01/2021

MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 25.24	20.31

CARP0525-008 06/01/2021

BRANCH & HILLSDALE COUNTIES

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 25.94	20.59

CARP0706-014 06/01/2020

ARENAC, GLADWIN, HURON, MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 27.61	21.84

CARP0706-018 06/01/2021

SHIAWASSEE COUNTY

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 29.48	22.00

CARP1004-013 06/01/2021

LENAWEE COUNTY

	Rates	Fringes
CARPENTER (Form Work Only).....	$ 27.39	20.73

ELEC0008-012 05/25/2022

HILLSDALE & LENAWEE COUNTIES

	Rates	Fringes
ELECTRICIAN.....	$ 44.79	1.5%+15.61

ELEC0058-008 06/28/2021

HURON COUNTY

	Rates	Fringes
ELECTRICIAN.....	$ 45.17	26.01

ELEC0275-009 06/01/2021

MECOSTA COUNTY

	Rates	Fringes
ELECTRICIAN.....	$ 33.06	8.94+38%

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* ELEC0275-014 06/01/2022

OSCEOLA COUNTY (Townships of Richmond, Hersey, Evart & Orient)

	Rates	Fringes
ELECTRICIAN.....	$ 34.41	9.27+28%

ELEC0445-008 06/01/2022

BRANCH COUNTY

	Rates	Fringes
ELECTRICIAN	$ 35.40	23.29

ELEC0498-012 06/01/2021

OSCEOLA COUNTY (does not include the townships of Evart, Hersey, Orient and Richmond)

	Rates	Fringes
ELECTRICIAN	$ 32.41	20.05

ELEC0557-008 06/01/2020

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	$ 34.25	23.13

ELEC0665-018 05/31/2021

SHIAWASSEE COUNTY (Townships of Perry & Woodhull)

	Rates	Fringes
ELECTRICIAN	$ 37.50	24.04+5.5%

ELEC0692-017 06/01/2022

ARENAC & GLADWIN COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 35.31	38.03%+9.25

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 06/01/2020

SHIAWASSEE (All townships except Perry & Woodhull) & TUSCOLA (Township of Millington) COUNTIES

	Rates	Fringes
ELECTRICIAN	$ 39.17	23.51

ENGI0325-021 09/01/2021

POWER EQUIPMENT OPERATORS: Underground Construction (Including Sewer)

	Rates	Fringes
POWER EQUIPMENT OPERATOR		
GROUP 1	$ 35.92	24.85
GROUP 2	$ 31.03	24.85
GROUP 3	$ 30.53	24.85
GROUP 4	$ 30.25	24.85

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 06/01/2022

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	$ 44.13	24.85
Group 2	$ 40.83	24.85
Group 3	$ 38.18	24.85
Group 4	$ 36.47	24.85
Group 5	$ 28.13	24.85
Operating Engineers:		
AREA 2		
Group 1	$ 42.38	24.85
Group 2	$ 39.08	24.85
Group 3	$ 36.43	24.85
Group 4	$ 34.72	24.85
Group 5	$ 26.38	24.85

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 06/01/2019

ARENAC, GLADWIN, HURON, MIDLAND, SHIAWASSEE & TUSCOLA COUNTIES

	Rates	Fringes
IRONWORKER		
Reinforcing	$ 30.98	27.99
Structural	$ 36.77	29.03

IRON0055-011 07/01/2022

LENAWEE COUNTY

	Rates	Fringes
IRONWORKER, STRUCTURAL AND REINFORCING	$ 33.00	27.20

IRON0340-012 06/19/2017

BRANCH, HILLSDALE, MECOSTA & OSCEOLA COUNTIES

	Rates	Fringes
IRONWORKER, STRUCTURAL AND REINFORCING	$ 24.43	24.67

LABO0334-008 09/01/2018

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	$ 20.97	12.85
(4) Grade Checker	$ 21.28	12.85

LABO0334-019 09/01/2018

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	$ 20.97	12.85
(4) Grade Checker	$ 21.28	12.85

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 06/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

HILLSDALE & LENAWEE COUNTIES

	Rates	Fringes
LABORER		
Common or General	$ 27.45	13.20

LABO1075-011 06/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

SHIAWASSEE COUNTY

	Rates	Fringes
LABORER		
Common or General	$ 26.41	14.05

LABO1098-022 07/01/2022

EXCLUDES OPEN CUT CONSTRUCTION

ARENAC, GLADWIN, HURON, MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
LABORER		
Common or General	$ 23.44	12.95

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 05/04/2020

ARENAC, GLADWIN, HURON (West of M-53), MIDLAND & TUSCOLA COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 38.25	21.07

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 06/01/2020

BRANCH & HILLSDALE COUNTIES

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 38.79	23.08

PLUM0333-022 06/01/2020

LENAWEE COUNTY (Remainder of County)

	Rates	Fringes
PLUMBER/PIPEFITTER	$ 38.79	23.08

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 06/01/2020

	Rates	Fringes
TRUCK DRIVER		
Lowboy/Semi-Trailer Truck	$ 28.15	.50 + a+b

FOOTNOTE:
a. $470.70 per week.
b. $68.70 daily.

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* 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 ($15.00) or 13658 ($11.25). Please see the Note at the top of the wage determination for more information.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (ii)).

The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of

the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

* an existing published wage determination
* a survey underlying a wage determination
* a Wage and Hour Division letter setting forth a position on a wage determination matter
* a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISIO"

§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.

(c) 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.

(5) 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.

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.

CONTRACT FORMS

NOTICE OF ACCEPTANCE

Date of Issuance:

Owner:	City of Owosso	Owner's Contract No.:	
Engineer:	OHM Advisors	Engineer's Project No.:	0020-22-0070 & 0020-22-0080
Project:	Palmer 3A and Juniper Well House Designs, DWSRF #7491-01	Contract Name:	Palmer 3A and Juniper Well House Designs, DWSRF #7491-01

Bidder:

Bidder's Address:

TO BIDDER:

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

PALMER 3A AND JUNIPER WELL HOUSE DESIGNS

The Palmer 3A Project consists of demolition of the existing Palmer 3 wellhouse, abandonment of Palmer 3 Well, abandonment of 150 feet of water main; installation of one wellhouse, one vertical line-shaft turbine pump and 71 feet of water main, installation of a gas-powered generator and two automatic transfer switches.

The Juniper Project consists of installation of one wellhouse, one vertical line-shaft turbine pump and 1,544 feet of water main: 1,460 feet of 12-inch water main directionally drilled and 84 feet of 12-inch water main open cut. Installation of a gas-powered generator.

The Contract Price of the awarded Contract is: $ _____lump sum.

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

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

You must comply with the following conditions precedent within 10 days of the date of receipt of this Notice of Acceptance:

1. Deliver to Owner four (4) counterparts of the Agreement, fully executed by Bidder.
2. Deliver with the executed Agreement(s) the Contract security *[e.g., performance and payment bonds]* and insurance documentation as specified in the Instructions to Bidders and General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any):

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

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

Owner**:**

Authorized Signature

By:

Title:

Copy: Engineer

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

THIS AGREEMENT is by and between CITY OF OWOSSO ("Owner") and

_____ ("Contractor").

Owner and Contractor hereby agree as follows:

ARTICLE 1 – WORK

1.1 The Palmer 3A Project consists of demolition of the existing Palmer 3 wellhouse, abandonment of Palmer 3 Well, abandonment of 150 feet of water main; installation of one wellhouse, one vertical line-shaft turbine pump and 71 feet of water main, installation of a gas-powered generator and two automatic transfer switches.

1.2 The Juniper Project consists of installation of one wellhouse, one vertical line-shaft turbine pump and 1,544 feet of water main: 1,460 feet of 12-inch water main directionally drilled and 84 feet of 12-inch water main open cut. Installation of a gas-powered generator.

ARTICLE 2 – THE PROJECT

2.1 The Project, of which the Work under the Contract Documents is a part, is generally described as follows: Palmer 3A and Juniper Well House Designs, DWSRF #7491-01.

ARTICLE 3 – ENGINEER

3.1 The Project was designed by OHM Advisors.

3.2 The Owner has retained OHM Advisors, 34000 Plymouth Road, Livonia, MI 48150 ("Engineer") to act as Owner's representative, assume all duties and responsibilities, and have the rights and authority assigned to Engineer in the Contract Documents in connection with the completion of the Work in accordance with the Contract Documents.

ARTICLE 4 – CONTRACT TIMES

4.1 *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.

4.2 *Contract Times*: *Days*

A. Work onsite will commence within 5 days of issuance of the Notice to Proceed.

B. Substantial Completion: Complete demolition of existing Palmer 3 well house and abandonment of Palmer 3 well. Completion and startup of all pumps and equipment in both Palmer 3A and Juniper wellhouses with the exception of work specifically called out "BY OTHERS" in the

contract drawings and specifications. This work will be substantially completed within 45 calendar weeks after Notice to Proceed date.

C. The Work shall be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 4 calendar weeks of substantial completion.

4.3 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.1 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the times specified in Paragraph 4.2 above, plus any extensions thereof allowed in accordance with the Contract. The parties also recognize the delays, expense, and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. Substantial Completion: Contractor shall pay Owner $1,000.00 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified in Paragraph 4.2.B above for Substantial Completion until the Work is substantially complete.

2. Completion of Remaining Work: After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Time (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $1,000.00 for each day that expires after such time until the Work is completed and ready for final payment.

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

ARTICLE 5 – CONTRACT PRICE

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

A. For all Lump Sum Work, an amount equal to the sum of the extended prices (established for each separately identified item of Lump Sum Work):

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price
PALMER 3A WELL HOUSE WORK					
1	Demolition of Palmer 3 Wellhouse	LS	1		
2	Abandonment of Palmer 3 Well	LS	1		
3	Palmer 3 Water Main Abandonment	LS	1		
4	Well House Building and Site Work	LS	1		
5	Process Piping and Equipment Work	LS	1		
6	Electrical and Mechanical Work	LS	1		
7	12-inch Water Main – Open Cut	LS	1		
8	Allowance: Testing	LS	1	$6,000	$6,000
9	Allowance: Gas and Electric Utilities	LS	1	$30,000	$30,000
10	Allowance: Permits	LS	1	$2,000	$2,000
11	Inspector Days	Day		$680/Day	
Subtotal of All Palmer 3A Lump Sum Bid Items					
JUNIPER WELL HOUSE WORK					
12	Well House Building and Site Work	LS	1		
13	Process Piping and Equipment Work	LS	1		
14	Electrical and Mechanical Work	LS	1		
15	12-inch Water Main – Directional Drill	LS	1		
16	12-inch Water Main – Open Cut	LS	1		
17	Electrical Service Conduit Installation	LS	1		
18	Allowance: Testing	LS	1	$8,000	$8,000
19	Allowance: Gas and Electric Utilities	LS	1	$90,000	$90,000
20	Allowance: Permits	LS	1	$4,000	$4,000
21	Inspector Days	Day		$680/Day	
Subtotal of All Juniper Lump Sum Bid Items					

Contract Total of All Lump Sum Bid Items	

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

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

ARTICLE 6 – PAYMENT PROCEDURES

6.1 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions and Section 01 29 00 - PAYMENT PROCEDURES. Applications for Payment will be processed by Engineer as provided in the General Conditions

6.2 *Progress Payments*; *Retainage*

A. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment on a monthly schedule during performance of the Work, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

6.3 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 – CONTRACTOR'S REPRESENTATIONS

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

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

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

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

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

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

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

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

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

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

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

ARTICLE 8 – CONTRACT DOCUMENTS

8.1 *Contents*

A. The Contract Documents consist of the following:

1. City of Owosso Contract Conditions (pages 1 to 5, inclusive).
2. Local Preference Policy (pages 1 to 6, inclusive).
3. This Agreement (pages 1 to 8, inclusive).
4. Performance bond (pages 1 to 3, inclusive).
5. Payment bond (pages 1 to 3, inclusive).
6. Other bonds, N/A.
7. Contractor's Affidavit (pages 1 to 1, inclusive).
8. Contractor's Declaration (pages 1 to 1, inclusive).
9. General Conditions (pages 1 to 72, inclusive).
10. Supplementary Conditions (pages 1 to 9, inclusive).
11. Specifications as listed in the table of contents of the Project Manual.
12. The Drawings listed on the attached sheet index.
13. Addenda (number 1 to 2, inclusive).
14. Exhibits to this Agreement (enumerated as follows):
    a. Contractor's Bid.

b. State Revolving Fund Paperwork.

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

a. Notice to Proceed.

b. Work Change Directives.

c. Change Orders.

d. Field Orders.

B. The documents listed in Paragraph 8.1.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 8.

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

ARTICLE 9 – MISCELLANEOUS

9.1 *Terms*

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

9.2 *Assignment of Contract*

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

9.3 *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.

9.4 *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.

9.5 *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 9.5:

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 is to establish Bid prices at artificial, non-competitive levels; and

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

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

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

OWNER:	CONTRACTOR:
_____	_____
By: _____	By: _____
Title: _____	Title: _____
	(If Contractor is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)
Attest: _____	Attest: _____
Title: _____	Title: _____
Address for giving notices:	Address for giving notices:
City of Owosso	_____
301 West Main Street	_____
Owosso, MI 48867	_____
	License No.: _____ *(where applicable)*

(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.)

NOTICE TO PROCEED

Owner:	City of Owosso	Owner's Contract No.:	
Contractor:		Contractor's Project No.:	
Engineer:	OHM Advisors	Engineer's Project No.:	0020-22-0070 & 0020-22-0080
Project:	Palmer 3A and Juniper Well House Designs, DWSRF #7491-01	Contract Name:	Palmer 3A and Juniper Well House Designs, DWSRF #7491-01
		Effective Date of Contract:	

TO CONTRACTOR:

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on [_____, 2. *[see Paragraph 4.01 of the General Conditions]*

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work shall be done at the Site prior to such date. In accordance with the Agreement, all work is to be substantially completed within 45 calendar weeks after Notice to Proceed date.
Final completion of all work shall occur within 4 calendar weeks of substantial completion.

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

- Provide baseline construction schedule
- Provide Schedule of Values
- Provide preconstruction videos of the work areas
- Provide site specific safety plan
- Provide contact information for project superintendent/manager

Owner**:**

Authorized Signature

By: Ryan E. Suchanek

Title: Director of Public Services & Utilities

Date Issued:

Copy: Engineer

SECTION 00 61 13 - PERFORMANCE BOND

CONTRACTOR *(name and address)*:

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

OWNER *(name and address)*:
City of Owosso
301 W. Main Street
Owosso, Michigan 48867

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

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

> 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
>
> 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.

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

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

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

7.2 additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and

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

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

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

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

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

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

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

14. Definitions

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

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

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

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

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

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

16. Modifications to this Bond are as follows:

SECTION 00 61 13.16 - PAYMENT BOND

CONTRACTOR *(name and address)*:

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

OWNER *(name and address)*:
City of Owosso
301 W. Main Street
Owosso, Mi. 48867

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

BOND
Bond Number:
Date *(not earlier than the Effective Date of the Agreement of the Construction Contract)*:
Amount:
Modifications to this Bond Form: ☐ None ☐ See Paragraph 16

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

CONTRACTOR AS PRINCIPAL

_____ *(seal)*
Contractor's Name and Corporate Seal

By: _____
Signature

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

SURETY

_____ *(seal)*
Surety's Name and Corporate Seal

By: _____
Signature *(attach power of attorney)*

_____
Print Name

_____
Title

Attest: _____
Signature

_____
Title

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

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

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

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

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

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

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

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

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

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

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

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

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

   7.2 Pay or arrange for payment of any undisputed amounts.

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

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

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

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

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

12. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent

jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

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

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

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

16. **Definitions**

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

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

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

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

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

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

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

18. Modifications to this Bond are as follows:

SECTION 00 65 16 - CERTIFICATE OF SUBSTANTIAL COMPLETION

Owner:	City of Owosso	Owner's Grant No.:	DWSRF#7491-01
Contractor:		Contractor's Project No.:	
Engineer:	OHM Advisors	Engineer's Project No.:	0020-22-0070 & 0020-22-0080
Project:	Palmer 3A and Juniper Well House Designs, DWSRF #7491-01	Contract Name:	Palmer 3A and Juniper Well House Designs, DWSRF #7491-01

This [preliminary] [final] Certificate of Substantial Completion applies to:

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

_____
Date of Substantial Completion

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

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

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work shall be as provided in the Contract, except as amended as follows: *[Note: Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.]*

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

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

The following documents are attached to and made a part of this Certificate: *[punch list; others]*

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.

EXECUTED BY ENGINEER:

By: _____
(Authorized signature)

Title: _____

Date: _____

RECEIVED:

By: _____
Owner (Authorized Signature)

Title: _____

Date: _____

RECEIVED:

By: _____
Contractor (Authorized Signature)

Title: _____

Date: _____

CONTRACTOR'S AFFIDAVIT

STATE OF MICHIGAN

COUNTY OF SHIAWASSEE

The undersigned, _____(contractor name) hereby represents that on _____ , 2023 he (it) was awarded a Contract by City of Owosso hereinafter called the OWNER, to peform all contract work related to PALMER 3A AND JUNIPER WELL HOUSE DESIGNS in accordance with the terms and conditions of Contract No. 0020-22-0070 & 0020-22-0080 and the undersigned further represents that the subject work has now been accomplished and the said Contract has now been completed.

The undersigned hereby warrants and certifies that all of his (its) indebtedness arising by reason of said Contract has been fully or satisfactorily secured, and that all claims from subcontractors and others for labor and material used in accomplishing the said project, as well as all other claims arising from performance of said Contract, have been fully paid or satisfactorily secured. The undersigned further agrees that if any such claim should hereafter arise, he (it) shall assume responsibility for same immediately upon request to do so by the OWNER.

The undersigned, for a valuable consideration, receipt of which is hereby acknowledged, does further hereby waive, release and relinquish any and all claims or right of lien which the undersigned now has or may hereafter acquire upon the subject premises for labor and material used in accomplishing said project owned by the OWNER.

This affidavit is freely and voluntarily given with full knowledge of the facts on this _____ day of _____ , 2023.

_____

Contractor
By: _____

Title _____

Subscribed and sworn to before me, a Notary Public in and for Shiawassee County, Michigan, on this _____day of _____, 2023.

Notary Public:

My Commission expires: _____

CONTRACTOR'S DECLARATION

I HEREBY DECLARE THAT I HAVE NOT, during the period

_____ to

_____ A.D., 20 _____ performed any work, furnished any material, sustained any loss, damage or delay for any reason, including soil conditions encountered or created, or otherwise done anything for which I shall ask, demand, sue for or claim compensation from the by City of Owosso or his agents, in addition to the regular items set forth in the Contract numbered 0020-22-0070 & 0020-22-0080 and dated _____ A.D., 20 ____ for the Agreement executed between myself and the OWNER, and in the Change Orders for work issued by the OWNER in writing as provided thereunder, except as I hereby make claim for additional compensation and/or extension of time, as set forth on the itemized statement attached hereto.

There (is) (is not) an itemized statement attached.

Date: _____

_____

By: _____

Title: _____

SECTION 00 70 00 - STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

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

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

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

3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

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

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

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

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

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

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

10. *Claim*—(a) A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein: seeking an adjustment of Contract Price or Contract Times, or both; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract; or (b) a demand or assertion by Contractor directly to Owner, duly submitted in compliance

with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal; or seeking resolution of a contractual issue that Engineer has declined to address. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to (a) the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. §§9601 et seq. ("CERCLA"); (b) the Hazardous Materials Transportation Act, 49 U.S.C. §§5501 et seq.; (c) the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 et seq. ("RCRA"); (d) the Toxic Substances Control Act, 15 U.S.C. §§2601 et seq.; (e) the Clean Water Act, 33 U.S.C. §§1251 et seq.; (f) the Clean Air Act, 42 U.S.C. §§7401 et seq.; or (g) any other federal, state, or local statute, law, rule, regulation, ordinance, resolution, code, order, or decree regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

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

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

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

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

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

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

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

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

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

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

22. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated in the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, does not establish a Hazardous Environmental Condition.

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

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

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

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

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

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

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

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

31. *Project Manual*—The written documents prepared for, or made available for, procuring and constructing the Work, including but not limited to the Bidding Documents or other construction procurement documents, geotechnical and existing conditions information, the Agreement, bond forms, General Conditions, Supplementary Conditions, and Specifications. The contents of the Project Manual may be bound in one or more volumes.

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

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

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

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

36. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and

submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

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

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

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

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

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

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

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

44. *Technical Data*—Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (a) subsurface conditions at the Site, or physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities) or (b) Hazardous Environmental Conditions at the Site. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then the data contained in boring logs, recorded measurements of subsurface water levels, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical or environmental report prepared for the Project and made available to Contractor are hereby defined as Technical Data with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06.

45. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including but not limited to those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, fiber optic transmissions, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

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

47. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the

result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

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

1.02 *Terminology*

A. The words and terms discussed in the following paragraphs are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*:

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

C. *Day*:

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

D. *Defective*:

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

a. does not conform to the Contract Documents; or

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

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

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

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

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

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

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

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

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

A. *Bonds*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

B. *Evidence of Contractor's Insurance*: When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each named insured and additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract), the certificates and other evidence of insurance required to be provided by Contractor in accordance with Article 6.

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

2.02 *Copies of Documents*

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

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

2.03 *Before Starting Construction*

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

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

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

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

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

2.05 *Initial Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.03.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.

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

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

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

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may transmit, and shall accept, Project-related correspondence, text, data, documents, drawings, information, and graphics, including but not limited to Shop Drawings and other

submittals, in electronic media or digital format, either directly, or through access to a secure Project website.

B. If the Contract does not establish protocols for electronic or digital transmittals, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. When transmitting items in electronic media or digital format, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the items, or from those established in applicable transmittal protocols.

ARTICLE 3 – DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

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

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

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

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

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

3.02 *Reference Standards*

A. Standards Specifications, Codes, Laws and Regulations

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

2. No provision of any such standard specification, manual, reference standard, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*:

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

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

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

B. *Resolving Discrepancies*:

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

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

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

3.04 *Requirements of the Contract Documents*

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

B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract

Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

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

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

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

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

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

ARTICLE 4 – COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

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

4.02 *Starting the Work*

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

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or

requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

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

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

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

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

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Times and Contract Price. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

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

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

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

2. abnormal weather conditions;

3. acts or failures to act of utility owners (other than those performing other work at or adjacent to the Site by arrangement with the Owner, as contemplated in Article 8); and

4. acts of war or terrorism.

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

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

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

G. Contractor must submit any Change Proposal seeking an adjustment in Contract Price or Contract Times under this paragraph within 30 days of the commencement of the delaying, disrupting, or interfering event.

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

5.01 *Availability of Lands*

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

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

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

5.02 *Use of Site and Other Areas*

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

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

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.12, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

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

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

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

5.03 *Subsurface and Physical Conditions*

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

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

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

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or

make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

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

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

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

5.04 *Differing Subsurface or Physical Conditions*

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

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

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

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

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

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

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

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

D. *Possible Price and Times Adjustments*:

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

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

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

   c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.

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

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

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

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

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

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

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or adjacent to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer do not warrant or guarantee the accuracy or completeness of any such information or data provided by others; and

2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

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

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

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

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

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

C. *Engineer's Review*: Engineer will promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated in the Contract Documents, or was not shown or indicated with reasonable accuracy; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the Underground Facility in question; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and advise Owner in writing of Engineer's findings, conclusions, and recommendations. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

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

E. *Possible Price and Times Adjustments*:

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

    a. Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated the existence or actual location of the Underground Facility in question;

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

c. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times; and

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

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

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

5.06 *Hazardous Environmental Conditions at Site*

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

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

2. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data (as defined in Article 1) contained in any geotechnical or environmental report prepared for the Project and made available to Contractor. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:

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

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

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

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

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

costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

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

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off.

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

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

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

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

ARTICLE 6 – BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

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

B. All bonds shall be in the form prescribed by the Contract except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (as amended and supplemented) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

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

D. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or its right to do business is terminated in any state or jurisdiction where any part of the Project is located, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the bond and surety requirements above.

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

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

6.02 *Insurance—General Provisions*

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

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

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

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

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

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

G. If Contractor has failed to obtain and maintain required insurance, Owner may exclude the Contractor from the Site, impose an appropriate set-off against payment, and exercise Owner's termination rights under Article 16.

H. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price shall be adjusted accordingly.

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

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

6.03 *Contractor's Insurance*

A. *Workers' Compensation*: Contractor shall purchase and maintain workers' compensation and employer's liability insurance for:

1. claims under workers' compensation, disability benefits, and other similar employee benefit acts.

2. United States Longshoreman and Harbor Workers' Compensation Act and Jones Act coverage (if applicable).

3. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees (by stop-gap endorsement in monopolist worker's compensation states).

4. Foreign voluntary worker compensation (if applicable).

B. *Commercial General Liability—Claims Covered*: Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against:

1. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees.

2. claims for damages insured by reasonably available personal injury liability coverage.

3. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

C. *Commercial General Liability—Form and Content*: Contractor's commercial liability policy shall be written on a 1996 (or later) ISO commercial general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage:

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

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

2. Blanket contractual liability coverage, to the extent permitted by law, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.

3. Broad form property damage coverage.

4. Severability of interest.

5. Underground, explosion, and collapse coverage.

6. Personal injury coverage.

7. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together); or CG 20 10 07 04 and CG 20 37 07 04 (together); or their equivalent.

8. For design professional additional insureds, ISO Endorsement CG 20 32 07 04, "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

D. *Automobile liability*: Contractor shall purchase and maintain automobile liability insurance against claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy shall be written on an occurrence basis.

E. *Umbrella or excess liability*: Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the paragraphs above. Subject to industry-standard exclusions, the coverage afforded shall follow form as to each and every one of the underlying policies.

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

G. *Additional insureds*: The Contractor's commercial general liability, automobile liability, umbrella or excess, and pollution liability policies shall include and list as additional insureds Owner and Engineer, and any individuals or entities identified in the Supplementary Conditions; include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds; and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby (including as applicable those arising from both ongoing and completed operations) on a non-contributory basis. Contractor shall obtain all necessary endorsements to support these requirements.

H. *Contractor's professional liability insurance*: If Contractor will provide or furnish professional services under this Contract, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance shall provide protection against claims arising out of performance of professional design or related services, and caused by a negligent error, omission, or act for which the insured party is legally liable. It shall be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. If such professional design services are performed by a Subcontractor, and not by Contractor itself, then the requirements of this paragraph may be satisfied through the purchasing and maintenance of such insurance by such Subcontractor.

I. *General provisions*: The policies of insurance required by this Paragraph 6.03 shall:

1. include at least the specific coverages provided in this Article.

2. be written for not less than the limits of liability provided in this Article and in the Supplementary Conditions, or required by Laws or Regulations, whichever is greater.

3. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed, or renewal refused until at least 10 days prior written notice has been given to Contractor. Within three days of receipt of any such written notice, Contractor shall provide a copy of the notice to Owner, Engineer, and each other insured under the policy.

4. remain in effect at least until final payment (and longer if expressly required in this Article) and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract Documents.

5. be appropriate for the Work being performed and provide protection from claims that may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable.

J. The coverage requirements for specific policies of insurance must be met by such policies, and not by reference to excess or umbrella insurance provided in other policies.

6.04 *Owner's Liability Insurance*

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

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

6.05 *Property Insurance*

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

1. include the Owner and Contractor as named insureds, and all Subcontractors, and any individuals or entities required by the Supplementary Conditions to be insured under such builder's risk policy, as insureds or named insureds. For purposes of the remainder of this Paragraph 6.05, Paragraphs 6.06 and 6.07, and any corresponding Supplementary Conditions, the parties required to be insured shall collectively be referred to as "insureds."

2. be written on a builder's risk "all risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire; lightning; windstorm; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; flood; collapse; explosion; debris removal;

demolition occasioned by enforcement of Laws and Regulations; water damage (other than that caused by flood); and such other perils or causes of loss as may be specifically required by the Supplementary Conditions. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake; volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance may be provided through other insurance policies acceptable to Owner and Contractor.

3. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

4. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects).

5. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier).

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

7. allow for partial occupation or use of the Work by Owner, such that those portions of the Work that are not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

8. allow for the waiver of the insurer's subrogation rights, as set forth below.

9. provide primary coverage for all losses and damages caused by the perils or causes of loss covered.

10. not include a co-insurance clause.

11. include an exception for ensuing losses from physical damage or loss with respect to any defective workmanship, design, or materials exclusions.

12. include performance/hot testing and start-up.

13. be maintained in effect, subject to the provisions herein regarding Substantial Completion and partial occupancy or use of the Work by Owner, until the Work is complete.

B. *Notice of Cancellation or Change*: All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 6.05 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured.

C. *Deductibles*: The purchaser of any required builder's risk or property insurance shall pay for costs not covered because of the application of a policy deductible.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide notice of such occupancy or use to the builder's risk insurer. The builder's risk insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy; rather, those portions of the Work that are occupied or used by Owner may come off the builder's risk policy, while those portions of the Work not yet occupied or used by Owner shall remain covered by the builder's risk insurance.

E. *Additional Insurance*: If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.05, it may do so at Contractor's expense.

F. *Insurance of Other Property*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, such as tools, construction equipment, or other personal property owned by Contractor, a Subcontractor, or an employee of Contractor or a Subcontractor, then the entity or individual owning such property item will be responsible for deciding whether to insure it, and if so in what amount.

6.06 *Waiver of Rights*

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

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

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

2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property

insurance maintained on the completed Project or part thereof by Owner during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06.

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

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

6.07 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.05 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.05 shall distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the money so received applied on account thereof, and the Work and the cost thereof covered by Change Order, if needed.

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

7.01 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

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

7.02 *Labor; Working Hours*

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

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

7.03 *Services, Materials, and Equipment*

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

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

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

7.04 *"Or Equals"*

A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment, or items from other proposed suppliers under the circumstances described below.

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

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

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

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

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

4) it is not objectionable to Owner.

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

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

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

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

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

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

E. *Treatment as a Substitution Request*: If Engineer determines that an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer considered the proposed item as a substitute pursuant to Paragraph 7.05.

7.05 *Substitutes*

A. Unless the specification or description of an item of material or equipment required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of material or equipment under the circumstances described below. To the extent possible such requests shall be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests

for review of proposed substitute items of material or equipment from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.05.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

   a. shall certify that the proposed substitute item will:

      1) perform adequately the functions and achieve the results called for by the general design,

      2) be similar in substance to that specified, and

      3) be suited to the same use as that specified.

   b. will state:

      1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times,

      2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

      3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

   c. will identify:

      1) all variations of the proposed substitute item from that specified, and

      2) available engineering, sales, maintenance, repair, and replacement services.

   d. shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

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

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

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

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

7.06 *Concerning Subcontractors, Suppliers, and Others*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner.

B. Contractor shall retain specific Subcontractors, Suppliers, or other individuals or entities for the performance of designated parts of the Work if required by the Contract to do so.

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

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

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

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

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

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

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

J. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors, Suppliers, and all other individuals or entities performing or furnishing any of the Work.

K. Contractor shall restrict all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed herein.

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

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

N. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by the particular Subcontractor or Supplier.

O. Nothing in the Contract Documents:

1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier, or other individual or entity; nor

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

7.07 *Patent Fees and Royalties*

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

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

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

7.08 *Permits*

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

7.09 *Taxes*

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

7.10 *Laws and Regulations*

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

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

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

C. Owner or Contractor may give notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.11 *Record Documents*

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

7.12 *Safety and Protection*

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

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

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

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

B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner; the owners of adjacent property, Underground Facilities, and other utilities; and other contractors and utility owners performing work at or adjacent to the Site, when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

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

E. All damage, injury, or loss to any property referred to in Paragraph 7.12.A.2 or 7.12.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

F. Contractor's duties and responsibilities for safety and protection shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 15.06.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

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

7.13 *Safety Representative*

A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

7.14 *Hazard Communication Programs*

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

7.15 *Emergencies*

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

7.16 *Shop Drawings, Samples, and Other Submittals*

A. *Shop Drawing and Sample Submittal Requirements*:

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

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

b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;

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

d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

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

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

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

1. *Shop Drawings*:

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

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

2. *Samples*:

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

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

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

C. *Other Submittals*: Contractor shall submit other submittals to Engineer in accordance with the accepted Schedule of Submittals, and pursuant to the applicable terms of the Specifications.

D. *Engineer's Review*:

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

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

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

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

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

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

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

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

E. *Resubmittal Procedures*:

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

2. Contractor shall furnish required submittals with sufficient information and accuracy to obtain required approval of an item with no more than three submittals. Engineer will record Engineer's time for reviewing a fourth or subsequent submittal of a Shop Drawings, sample, or other item requiring approval, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due to Contractor to secure reimbursement for such charges.

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

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on Contractor's warranty and guarantee.

B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

1. observations by Engineer;

2. recommendation by Engineer or payment by Owner of any progress or final payment;

3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. use or occupancy of the Work or any part thereof by Owner;

5. any review and approval of a Shop Drawing or Sample submittal;

6. the issuance of a notice of acceptability by Engineer;

7. any inspection, test, or approval by others; or

8. any correction of defective Work by Owner.

D. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract shall govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other

than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

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

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

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

7.19 *Delegation of Professional Design Services*

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

B. If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.

C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.

D. Pursuant to this paragraph, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 7.16.D.1.

E. Contractor shall not be responsible for the adequacy of the performance or design criteria specified by Owner or Engineer.

ARTICLE 8 – OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any utility work at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford each other contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

D. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 8, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

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

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

3. the extent of such authority and responsibilities.

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

8.03 *Legal Relationships*

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

B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due to Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this paragraph.

C. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due to Contractor.

D. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and

other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9 – OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

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

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents shall be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

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

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10 – ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.08. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and

limitations on the responsibilities thereof will be as provided in Paragraph 10.08. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent, or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

10.04 *Rejecting Defective Work*

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

10.05 *Shop Drawings, Change Orders and Payments*

A. Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, are set forth in Paragraph 7.16.

B. Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, are set forth in Paragraph 7.19.

C. Engineer's authority as to Change Orders is set forth in Article 11.

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

10.06 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.07 *Decisions on Requirements of Contract Documents and Acceptability of Work*

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

10.08 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 15.06.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

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

10.09 *Compliance with Safety Program*

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

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

11.01 *Amending and Supplementing Contract Documents*

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

1. *Change Orders*:

a. If an amendment or supplement to the Contract Documents includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order. A Change Order also may be used to establish amendments and supplements of the Contract Documents that do not affect the Contract Price or Contract Times.

b. Owner and Contractor may amend those terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, without the recommendation of the Engineer. Such an amendment shall be set forth in a Change Order.

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

3. *Field Orders*: Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and

will be binding on Owner and also on Contractor, which shall perform the Work involved promptly. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.02 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Such changes shall be supported by Engineer's recommendation, to the extent the change involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters. Such changes may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work shall be performed under the applicable conditions of the Contract Documents. Nothing in this paragraph shall obligate Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.03 *Unauthorized Changes in the Work*

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

11.04 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment of Contract Price shall comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

1. where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03); or

2. where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.04.C.2); or

3. where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.04.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or

2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

    a. for costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee shall be 15 percent;

    b. for costs incurred under Paragraph 13.01.B.3, the Contractor's fee shall be five percent;

    c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.01.C.2.a and 11.01.C.2.b is that the Contractor's fee shall be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.A.1 and 13.01.A.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of five percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted work the maximum total fee to be paid by Owner shall be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the work;

    d. no fee shall be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;

    e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

    f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 11.04.C.2.a through 11.04.C.2.e, inclusive.

11.05 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times shall comply with the provisions of Paragraph 11.06. Any Claim for an adjustment in the Contract Times shall comply with the provisions of Article 12.

B. An adjustment of the Contract Times shall be subject to the limitations set forth in Paragraph 4.05, concerning delays in Contractor's progress.

11.06 *Change Proposals*

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

    1. *Procedures*: Contractor shall submit each Change Proposal to Engineer promptly (but in no event later than 30 days) after the start of the event giving rise thereto, or after

such initial decision. The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal. The supporting data shall be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event. Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal.

2. *Engineer's Action*: Engineer will review each Change Proposal and, within 30 days after receipt of the Contractor's supporting data, either deny the Change Proposal in whole, approve it in whole, or deny it in part and approve it in part. Such actions shall be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

3. *Binding Decision*: Engineer's decision will be final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

B. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice shall be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

11.07 *Execution of Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.02, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise), or other engineering or technical matters; and

4. changes in the Contract Price or Contract Times, or other changes, which embody the substance of any final and binding results under Paragraph 11.06, or Article 12.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of this Paragraph 11.07, it shall be deemed to be of full force and effect, as if fully executed.

11.08 *Notification to Surety*

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

ARTICLE 12 – CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor shall be submitted to the Claims process set forth in this Article:

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

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

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

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

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

D. *Mediation*:

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

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

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

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

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

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

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

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. To determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 13.01.C, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

5. Supplemental costs including the following:

    a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

    b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

    c. Rentals of all construction equipment and machinery, and the parts thereof, whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

    d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

    e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

    f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 6.05), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable.

Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

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

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

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

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

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

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

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

13.02 *Allowances*

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

B. *Cash Allowances*: Contractor agrees that:

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

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.

C. *Contingency Allowance*: Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of the following paragraph.

E. Within 30 days of Engineer's written decision under the preceding paragraph, Contractor may submit a Change Proposal, or Owner may file a Claim, seeking an adjustment in the Contract Price if:

1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement;

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

3. Contractor believes that it is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price, and the parties are unable to agree as to the amount of any such increase or decrease.

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

14.01 *Access to Work*

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

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work shall be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

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

Such inspections and tests shall be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering shall be at Contractor's

expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

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

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work shall be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require special inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, then Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

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

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

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

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

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*:

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens, and evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

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

C. *Review of Applications*:

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the

accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

a. the Work has progressed to the point indicated;

b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

a. to supervise, direct, or control the Work, or

b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or

c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or

d. to make any examination to ascertain how or for what purposes Contractor has used the money paid on account of the Contract Price, or

e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

a. the Work is defective, requiring correction or replacement;

b. the Contract Price has been reduced by Change Orders;

c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*:

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

a. claims have been made against Owner on account of Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages on account of Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. the Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. the Contract Price has been reduced by Change Orders;

i. an event that would constitute a default by Contractor and therefore justify a termination for cause has occurred;

j. liquidated damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

l. there are other items entitling Owner to a set off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed shall be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 15.01.C.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

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

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which shall fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have seven days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through E for that part of the Work.

2. At any time Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.05 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and

will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*:

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.11), and other documents, Contractor may make application for final payment.

2. The final Application for Payment shall be accompanied (except as previously delivered) by:

a. all documentation called for in the Contract Documents;

b. consent of the surety, if any, to final payment;

c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

d. a list of all disputes that Contractor believes are unsettled; and

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

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Application and Acceptance*:

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the Application for Payment to Owner for payment. Such recommendation shall account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. At the same time Engineer will also give written notice

to Owner and Contractor that the Work is acceptable, subject to the provisions of Paragraph 15.07. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment.

D. *Payment Becomes Due*: Thirty days after the presentation to Owner of the final Application for Payment and accompanying documentation, the amount recommended by Engineer (less any further sum Owner is entitled to set off against Engineer's recommendation, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions above with respect to progress payments) will become due and shall be paid by Owner to Contractor.

15.07 *Waiver of Claims*

A. The making of final payment will not constitute a waiver by Owner of claims or rights against Contractor. Owner expressly reserves claims and rights arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 15.05, from Contractor's failure to comply with the Contract Documents or the terms of any special guarantees specified therein, from outstanding Claims by Owner, or from Contractor's continuing obligations under the Contract Documents.

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

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents, or by any specific provision of the Contract Documents), any Work is found to be defective, or if the repair of any damages to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas used by Contractor as permitted by Laws and Regulations, is found to be defective, then Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such other adjacent areas;

2. correct such defective Work;

3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting therefrom.

B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all claims, costs, losses, and damages (including but not

limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others).

C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

E. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16 – SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

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

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) ten days written notice that Owner is considering a declaration that Contractor is in default and termination of the contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within seven days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

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

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

16.03 *Owner May Terminate For Convenience*

A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid on account of loss of anticipated overhead, profits, or revenue, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

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

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

ARTICLE 17 – FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this Article:

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

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

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

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

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

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

ARTICLE 18 – MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person, by a commercial courier service or otherwise, to the individual or to a member of the firm or to an officer of the corporation for which it is intended; or

2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the sender of the notice.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

18.03 *Cumulative Remedies*

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

18.04 *Limitation of Damages*

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

18.05 *No Waiver*

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

18.06 *Survival of Obligations*

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

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Headings*

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

END OF SECTION 00 70 00

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SECTION 00 73 00 – SUPPLEMENTARY GENERAL CONDITIONS

These Supplementary General Conditions amend or supplement the Standard General Conditions of the Construction Contract and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect. Further, the provisions of the City of Owosso General Conditions shall take precedence in resolving any conflict or discrepancy between such provisions of the City of Owosso General Conditions, General Conditions and the Supplementary General Conditions described herein.

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 General Conditions is the same as the address system in the General Conditions; with the prefix “SC” added thereto.

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

SC-1.01.A. Defined Terms

Delete the period at the end of paragraph 1.01.A and add the following language:

; except where the terms “Architect,” “Engineer,” and “Contractor” are proceeded 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.8. *Change Order*

Add the following language at the end of the last sentence of Paragraph 1.01.A.8:

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

SC-1.01.A.48. Add the following language at the end of the last sentence of Paragraph 1.01.A.48:

The term “Work Change Directive” shall be understood to refer to a “Work Order”. A Work Change Directive cannot change Contract Price or Contract Times without a subsequent Change Order.

SC-1.01.A.49. Add the following new Paragraph after Paragraph 1.01.A.48:

49. Abnormal Weather Conditions – Conditions of extreme or unusual weather for a given region, elevation or season as determined by Engineer. Extreme or unusual weather that is typical for a given region, elevation or season should not be considered Abnormal Weather Conditions.
50. Architect – The individual or entity named as Architect or Engineer in the Agreement
51. General Contractor – The Contractor as defined in Paragraph 1.01.A.16.
52. Manufacturer – An individual or entity that manufactures, assembles or fabricates products.
53. Products – Systems, materials, manufactured units, equipment, components and accessories used in the Work.

ARTICLE 2 – PRELIMINARY MATTERS

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

Add the following language at the end of the last sentence of Paragraph 2.01.A:

Contractor shall not start any work at the Site prior to Contractor delivering the required certificates and other evidence of insurance.

SC-2.01 *Evidence of Contractor's Insurance*

Add the following language at the end of the last sentence of Paragraph 2.01.B:

Facsimile, telegraphic, oral or other electronically transmitted Bond will not be considered. Attorneys-in-fact who execute the Bonds on behalf of the Surety shall affix to each Bond a certified and current copy of the power of attorney.

SC-2.01 *Evidence of Owner's Insurance*

Add the following language at the end of the last sentence of Paragraph 2.01.C:

Contractor shall not start any work at the Site prior to Owner delivering the required certificates and other evidence of insurance.

SC-2.02 *Copies of Documents*

Delete Paragraph 2.02.A in its entirety and insert the following in its place:

Engineer (Acting as Owner's agent) shall furnish to Contractor one set of Drawings and Project Manual in electronic portable document format. Hard copies will be furnished upon request at the cost of preparation, reproduction and shipping.

SC-2.03 *Preliminary Schedules*

Add the following language at the end of the last sentence of Paragraph 2.03.A.1:;
identifying the critical path for completing the Work, and identifying when all Subcontractors will be utilized, and taking into consideration any limitations on Working Hours;

SC-2.03 Delete Paragraph 2.03.A.3 in its entirety and insert the following in its place:

a preliminary schedule of values for all of the Work, subdivided into component parts in sufficient detail to serve as the basis for progress payments during construction. The schedule of values shall be broken out by trade and split between materials and labor. Prices shall include an appropriate amount of overhead and profit applicable to each item of Work.

ARTICLE 3 –DOCUMENTS: INTENT, REQUIREMENTS, REUSE

SC-3.04 Add the following new paragraph immediately after paragraph 3.04.B:

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 4 – COMMENCEMENT AND PROGRESS OF THE WORK

SC-4.01 Modify the third sentence to read: "In no event will the Contract Times commence to run later than the ninetieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Contract, whichever date is earlier."

SC-4.03Add the following paragraph immediately after paragraph 4.03.A:

During the progress of the work, the Contractor may encounter section line, fractional section line, and property controlling corner monuments. Insofar as is known, such public land survey corners and property monuments have been indicated on the plans. The Contractor shall be responsible for complying with the requirements of Michigan Public Act 34. Specifically, he shall be responsible for notifying the county surveyor before removing a public land survey corner monument for construction activities. In addition, if construction time constraints will result in the public land survey corner monument being removed for more than one year, then the Contractor shall arrange to have a temporary corner monument set until the permanent one can be re-established. The costs of removing and replacing public land survey corner monuments, as well as setting temporary corner monuments shall be the responsibility of the Contractor unless pay items are provided in the bid form for these tasks. The Contractor shall not remove any such monument until the Engineer has witness points as reference for resetting of such monuments. After referencing has been done and suitable permanent sketches prepared, the Engineer will give permission to the Contractor for removal of the monument. Monuments and monument boxes shall be reset only after all backfilling has fully settled.

The Contractor shall protect and preserve all monument points, property corners, grade stakes, line and reference points. Where stakes and markers are disturbed or removed due to operations under this Contract, the Contractor shall be charged at invoice cost by the Engineer for replacing the points. Care shall be exercised by the Contractor when operating near the markers, as any carelessness in operations will also cause a time delay to the schedule due to additional stakeout time required to replace reference points, lines, etc.

The Contractor shall accurately locate the work from reference points established by the Engineer along the surface of the ground and line of work.

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

SC-5.01Add the following new paragraph immediately after paragraph 5.01A:

Prior to the start of construction, the Contractor shall verify with the Owner that any required easements have been obtained. The Contractor shall keep his work operations

within these easements and shall be responsible for complying with any easement conditions that are shown on the plans or stated in the Contract documents.

SC-5.02 Add the following paragraph immediately after paragraph 5.02.A:

The Contractor's operations in public streets or alleys shall be confined to as small a space as practicable, so as not to cause undue inconvenience to the public or abutting properties, and shall be subject to the approval of the Engineer.

Where the Contractor wishes to work on or stockpile materials on nearby properties, it will be his responsibility to contact the property owner for permission. Upon request, the Contractor shall provide a copy of written permission from any affected property owner. The Owner will not become involved with any such agreements and will not be held responsible for any damages that the Contractor may cause to private property. The Contractor shall not be compensated for restoration of private properties and stockpile areas unless said areas were within the original project limits.

SC-5.03 Add the following new paragraph immediately after paragraph 5.03.B:

C Any geotechnical information that was prepared for this project is included in Document 00 31 32 – Geotechnical Data. This information, if provided, is given to bidders as an aid in determining the character of the soil and groundwater conditions. The Owner does not guarantee that the ground encountered during construction will conform to the borings. Bidders should secure such other information as they consider necessary to check and supplement the above data.

SC-5.05 Add the following paragraph to 5.05.A:

3. If a public line and/or customer service line is damaged by Contractor, Contractor shall give verbal notice within one (1) hour and written notice within 24 hours to the Owner and Engineer.

ARTICLE 6 – BONDS AND INSURANCE

SC-6.03 Contractor's Liability Insurance

Delete in its entirety and replace with the following:

To the fullest extent permitted by law the Contractor agrees to defend, pay on behalf of, indemnify, and hold harmless the City of Owosso, its elected and appointed officials, employees, agents and volunteers, and others working on behalf of the City of Owosso against any and all claims, demands, suits, or loss, including all costs connected therewith, and for any damages which may be asserted, claimed, or recovered against or from the City of Owosso, by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof, for all actions of the Contractor.

Contractor shall not commence work under this contract until they have obtained the insurance required under this paragraph, and shall keep such insurance in force during the entire life of this contract. All coverage shall be with insurance companies licensed and admitted to do business in the State of Michigan and acceptable to the City of Owosso. The requirements below should not be interpreted to limit the liability of Contractor. All deductibles and SIR's are the responsibility of Contractor. Contractor shall procure and maintain the following insurance coverage:

a. Worker's Compensation Insurance including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

b. Commercial General Liability Insurance on an "Occurrence Basis" with limits of liability not less than $3,000,000 per occurrence and aggregate. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent, if not already included. (E) Explosion, Collapse, and Underground (XCU) coverage, if applicable. Limits may be obtained by the use of primary and excess/umbrella liability policies.

c. Automobile Liability including Michigan No-Fault Coverages, with limits of liability not less than $3,000,000 per occurrence, combined single limit for Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

d. Owners' and Contractor Protective Liability: The Contractor shall procure and maintain during the life of this contract, a separate Owners' and Contractor's Protective Liability Policy with limits of liability not less than $3,000,000 per occurrence and aggregate for Personal Injury, Bodily Injury, and Property Damage. The City of Owosso shall be the "Named Insured" on said coverage.

e. Additional Insured: Commercial General Liability and Automobile Liability as described above shall include an endorsement stating the City of Owosso and OHM Advisors shall be listed as additional insured. It is understood and agreed by naming the City of Owosso and OHM Advisors as additional insured, coverage afforded is considered to be primary and any other insurance the City of Owosso and OHM Advisors may have in effect shall be considered secondary and/or excess.

f. Cancellation Notice: All policies, as described above, shall include an endorsement stating that is it understood and agreed Thirty (30) days, Ten (10) days for non-payment of premium, Advance Written Notice of Cancellation, shall be sent to: The City of Owosso, Brad Barrett, Finance Director, 301 W Main Owosso MI 48867.

g. Proof of Insurance Coverage: Contractor shall provide the City of Owosso at the time that the contracts are returned by him/her for execution, a Certificate of Insurance as well as the required endorsements. In lieu of required endorsements, if applicable, a copy of the policy sections where coverage is provided for additional insured and cancellation notice would be acceptable.

h. Builder's Risk Insurance Coverage equal to amount of this contract.

If any of the above coverages expire during the term of this contract, the Contractor shall deliver renewal certificates and endorsements to the City of Owosso at least ten (10) days prior to the expiration date.

SC-6.05 Property Insurance

Add the following language at the end of paragraph 6.05.A.1:

Additional insureds under this paragraph shall include the following:

a. Orchard, Hiltz & McCliment, Inc.

Add the following language immediately after paragraph 6.05.A.2

and shall also include flood, start-up and testing, offsite storage, and boiler and machinery insurance;

Add the following new paragraph immediately after paragraph 6.05.A.13:

8. be issued by an insurer who endorses the policy to reflect that, in the event of payment of any loss or damages, subrogation rights under these

Contract Documents will be waived by the insurer with respect to claims against the Owner or Engineer.

SC-6.06 Waiver of Rights
Delete paragraph 6.06.B in its entirety.
Delete paragraph 6.06.C in its entirety

ARTICLE 7 – CONTRACTOR'S RESPONSIBILITIES

SC-7.06 Add the following subsection P:

P. Contractor shall pay each Subcontractor under this Contract for satisfactory performance of its contract no later than ten (10) Calendar Days from the Contractor's receipt of payment from Owner. Contractor shall return retainage payments to each Subcontractor within 10 Calendar Days after the Subcontractor's work is satisfactorily completed. Any delay or postponement of payment from the above referenced time frame may occur only for good cause following written approval from Owner.

SC-7.08 Add the following language at the end of paragraph 7.08.A:

Additional provisions regarding permits and licenses are included in the General Requirements.

SC-7.08 Add the following paragraph immediately following paragraph 7.08.A:

B. The Contractor is responsible for obtaining all permits, including making all arrangements for inspection and payment of all governmental charges and inspection fees necessary for the commencement of Work as indicated by the following. Owner will assist with permit coordination when necessary; however, will not be responsible for any charges unless indicated below.
   1. Shiawassee County Health Department permit
      a. For Soil Erosion and Sediment Control permit
      b. Contractor to pay permit and inspection fees, and provide surety and insurance as required by Shiawassee County Health Department
   2. Shiawassee County Drain Commissioner permit
      a. For Utility Crossing under Osburn Drain permit
      b. Contractor to pay permit and inspection fees, if necessary, as required by Shiawassee County Drain Commissioner

SC-7.10 Delete the last sentence of paragraph 7.10

SC-7.13 Add the following language to the end of paragraph 7.13.A:

At a minimum, the safety representative will be certified in personal protective equipment, hazard communication, demolition and blasting, excavation, hand and power tools, welding and cutting, cranes, derricks, hoists, conveyors, scaffolding, confined space, CPR and first aid.

Add the following subsection B:

In the event there is an accident involving injury to any individual or damage to any property on or near the Work, Contractor shall provide to Owner and Engineer verbal notification within one hour and written notification within twenty-four hours of the event and shall be responsible for recording the location of the event and the circumstances

surrounding the event through photographs, interviewing witnesses, obtaining medical reports, police accident reports and other documentation that describes the event. Copies of such documentation shall be provided to Owner and Engineer, within forty-eight hours of the event.

SC-7.17 Add the following new paragraph immediately after Paragraph 7.17.A:

The Contractor, as a condition precedent to final payment, shall execute a guarantee to the Owner warranting for a period of two (2) years from date of final payment to keep in good order and repair any defect in all the work done under the Agreement, either by the Contractor, his subcontractors, or material suppliers, that may develop during said period due to improper materials, defective equipment, improper materials workmanship, or arrangements, and any other work affected in making good such imperfections shall also be made good, all without expense to the Owner, and Contractor shall execute, in favor of the Owner the attached Maintenance and Guarantee Bond. When specifications call for a guarantee period greater than one (1) year, Contractor shall provide such longer guarantee period.

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

SC-11.01 Add the following new paragraph 4 after 11.01 A.3:

4. upon receipt of a change order, Contractor shall promptly proceed with the change in the Work involved.

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

SC-13.03 Add the following paragraph immediately after paragraph 13.03.E.1:

2. Contractor's overhead, profit, and related costs for products and equipment order by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum.

SC-13.03 Delete paragraph 13.03.E.1 in its entirety and insert the following in its place:

1. the total cost of a particular item of Unit Price Work amounts to 10% or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25% from the estimated quantity of such item indicated in the Agreement;

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

SC-15.01. Add the following paragraph immediately after paragraph 15.01.B.3:

4. 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 Add the following new paragraphs immediately after 15.01.C.6.e:
f. Contractor has incurred liability for other costs in accordance with Contract Documents
g. Contractor's failure to maintain record documents in accordance with paragraph 7.11

SC-15.01.D Delete paragraph 15.01.D.1 and replace with the following:

1. Thirty days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 15.01.C) become due, and when due will be paid by Owner to Contractor.

ARTICLE 16– SUSPENSION OF WORK AND TERMINATION

SC-16.04 Modify paragraph 16.04.B by deleting the phrase "Owner has failed for 30 days to pay Contractor any sum finally determined to be due." and replace with "Owner fails for 60 days to pay Contractor any sum finally determined to be due."

ARTICLE 18 – MISCELLANEOUS

SC-18.09 Add paragraph 18.09:

SC-18.09 – Owner's Right to Audit:

A. Records means all records generated by or on behalf of Contractor and each Subcontractor and Supplier of Contractor, whether paper, electronic, or other media, which are in any way related to performance of or compliance with this Contract, including, without limitation: accounting records; written policies and procedures; subcontract files (including proposals of successful and unsuccessful bidders, bid recaps, etc.); original estimates and estimating work sheets; correspondence; change order files (including documentation covering negotiated settlements); back charge logs and supporting documentation; general ledger entries detailing cash and trade discounts earned, insurance rebates and dividends; lump sum agreements between Contractor and any Subcontractor or Supplier; records necessary to evaluate: Contract compliance, Change Order pricing, and any Claim submitted by Contractor or any of its payees; and any other Contractor record that may substantiate any charge related to this Contract.

B. Contractor shall allow Owner's agent or its authorized representative to inspect, audit, or reproduce, or all three, all Records generated by or on behalf of Contractor and each Subcontractor and Supplier, upon Owner's written request. Further, Contractor shall allow Owner's agent or authorized representative to interview any of Contractor's employees, all Subcontractors and all Suppliers, and all their respective employees.

C. Contractor shall retain all its Records, and require all its Subcontractors and Suppliers to retain their respective Records, during this Contract and for three years after final payment, until all audit and litigation matters that Owner has brought to the attention of Contractor are resolved, or longer if required by law, whichever is longer. Owner's right to inspect, audit, or reproduce Records, or interview employees of Contractor or its respective Subcontractors or Suppliers exists during this Contract, and for three years after final payment, until all audit and litigation matters that Owner has brought to Contractor's attention are resolved, or longer if required by law, whichever is longer, and at no cost to Owner, either from Contractor or any of its Subcontractors or Suppliers that may furnish Records or make employees available for interviewing.

D. Contractor must provide sufficient and accessible facilities during its normal business hours for Owner to inspect, audit, or reproduce Records, or all three, and to interview any person about the Records.

E. Contractor shall insert these requirements in each written contract between Contractor and any Subcontractor or Supplier and require each Subcontractor and Supplier to comply with these provisions.

SC-18.10 Add paragraph 18.10:

SC-18.10 – Liquidated Damages

A. If the Contractor fails to Substantially Complete the Work within the Contract Time, or extension of time granted by the Owner, then the Contractor will pay to the Owner the amount for liquidated damages as specified in the Agreement for each calendar day that the Contractor is in default after the time stipulated in the Contract Documents. The liquidated damages charged shall be deducted from the Contractor's progress payments and/or retained amount.

B. The Contractor will not be charged with liquidated damages or any excess cost when the delay in Substantial Completion of the Work is due to the following and the Contractor has given written notice of such delay within seven (7) calendar days to the Owner or Engineer.

   1. To any preference, priority or allocation order duly issued by the Owner;

   2. To unforeseeable causes beyond the control and without fault or negligence of the Contractor, including but not limited to, acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a Contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather and;

   3. To any delays of Subcontractors occasioned by any of the causes specified in Items A and B of this Article.

END OF SECTION 00 73 00

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Project information.
   2. Work covered by Contract Documents.
   3. Access to site.
   4. Coordination with occupants.
   5. Work restrictions.
   6. Specification and drawing conventions.

B. Related Requirements:
   1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Palmer 3A and Juniper Well House Designs
   1. Palmer 3A Project Location:
      a. Palmer 3: 1590 Palmer Ave
      b. Palmer 3A: 50 feet to the North of Palmer 3
      c. Palmer 2: 1510 Palmer Ave
   2. Juniper Project Location:
      a. Juniper 1: 1040 Juniper St

B. Owner: City of Owosso, 301 W. Main Street, Owosso Michigan 48867
   1. Owner's Representative: Ryan Suchanek, Utility Director

C. Engineer: OHM Advisors, 34000 Plymouth Road, Livonia Michigan 48150. Phone Number: 734-522-6711.
   1. Engineer’s Representative: Mr. Andrew VanWormer, Project Manager, Phone Number: 989-393-1712.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and consists of the following:
   1. The Palmer 3A Project consists of demolition of the existing Palmer 3 wellhouse, abandonment of Palmer 3 well, abandonment of 150 feet of water main; installation of one wellhouse, one vertical line-shaft turbine pump and 71 feet of water main, installation of a gas-powered generator and two automatic transfer switches.
   2. The Juniper Project consists of installation of one wellhouse, one vertical line-shaft turbine pump and 1,544 feet of water main: 1,460 feet of 12-inch water main directionally drilled and 84 feet of 12-inch water main open cut. Installation of a gas-powered generator.

B. Type of Contract.
   1. Project will be constructed under a single prime contract.

1.4 ACCESS TO SITES

A. General: Contractor shall have full use of Project sites for construction operations during construction period.

B. Use of Sites: Limit use of Project sites to work areas indicated. Do not disturb portions of Project sites beyond areas in which the Work is indicated.
   1. Limits: Confine construction operations to areas where work is identified.
   2. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.
      a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
      b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Contractor shall not operate heavy equipment on any side street within the project area without permission from the Engineer, Owner, and authority having jurisdiction.

1.5 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours:
   1. Palmer site: Limit work to normal business working hours of 7:00 a.m. to 7:00 p.m., Monday through Saturday, unless otherwise indicated.
   2. Juniper site: Limit work to normal business working hours of 8:00 a.m. to 7:00 p.m., Monday through Friday, unless otherwise indicated.
   3. Work shall be prohibited on recognized national holidays.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Engineer and Owner in writing not less than two days in advance of proposed utility interruptions.
   2. Obtain Engineer’s and Owner’s written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Engineer and Owner in writing not less than two days in advance of proposed disruptive operations.
   2. Obtain Engineer’s and Owner’s written permission before proceeding with disruptive operations.

E. Controlled Substances: Use of tobacco products and other controlled substances on Project sites are not permitted.

1.7 SUGGESTED SEQUENCE OF WORK

A. In general, it is the intention and understanding that the Contractor shall have control over the sequence and order of execution of the Work to be done under the Contract and over the method(s) accomplishing the results. Engineer may make such reasonable requirements as necessary for the proper and effective protection of work partially or wholly completed, and to these requirements, Contractor shall conform.

B. Palmer 3A Project: The following summary is the Engineer's suggested sequence of work:
   1. Install new watermain and underground conduits.
   2. Pour concrete building slab and generator pad.
   3. Install masonry and roof.
   4. Install process piping, pump, generator, and electrical equipment at Palmer 3A; install ATS at Palmer 2.
   5. Flush, disinfect, pressure test, and perform BacT on watermains. Coordinate with City for water source.
   6. Install final watermain connection at existing water main on Palmer Ave.
   7. Coordinate with Consumers Energy to move existing gas and electric utilities from Palmer 3 to Palmer 3A.
   8. Coordinate with OTHERS who will install SCADA equipment and electrical under separate contract with City.
   9. Perform Startup of all equipment; coordinate with SCADA provider who is performing work under separate contract with City.
   10. Demolish existing wellhouse Palmer 3; coordinate with Consumers Energy to remove existing electrical and gas utilities.
   11. Abandon section of existing water main.
   12. Abandon existing type 1 water well PALMER 3 per State of Michigan requirements.
   13. Install fence and drive.
   14. Restore Site.

C. Juniper Project: The following summary is the Engineer's suggested sequence of work:
   1. Install access drive.
   2. Install open cut and horizontal directionally drilled water main.
   3. Install underground conduit in vicinity of wellhouse.
   4. Pour concrete building slab and generator pad.
   5. Install underground conduit from wellhouse to location on North Gould Street. Final location to be specified by Consumers Energy.
   6. Install masonry and roof.
   7. Install process piping, pump, generator, and electrical equipment.
   8. Coordinate with Consumers Energy to connect new electric and gas services.
   9. Flush, disinfect, pressure test, and perform BacT on watermains. Coordinate with City for water source.
   10. Install watermain connection Tee at Hintz Road.
   11. Coordinate with OTHERS who will install SCADA equipment and electrical under separate contract with City.
   12. Perform Startup of all equipment; coordinate with SCADA provider who is performing work under separate contract with City.
   13. Install fence and restore access drive.
   14. Restore Site.

1.8 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
   1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
   2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
   3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 21 00 – ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Types of allowances include the following:
   1. Lump-sum allowances.

1.2 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Engineer of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the Work.

B. At Engineer's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Engineer from the designated supplier.

1.3 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances, in the form specified for Change Orders.

1.4 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.5 COORDINATION

A. Coordinate allowance items with other portions of the Work. Furnish templates as required to coordinate installation.

1.6 LUMP-SUM, UNIT-COST, AND QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Engineer under allowance and shall include taxes, freight**,** and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner under allowance shall be included as part of the Contract Sum and not part of the allowance.

1.7 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance.
   2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
   5. If the as-built costs associated with the allowance is less than those set forth in the bid item, the Owner will receive a credit based upon the remaining allowance amount. If the as-built costs are greater for those bid items, the Contractor will receive additional payments based upon the amount in excess via Change Order and in accordance with the provisions for Changes in the Work in the General Conditions. Contractor should make no assumptions regarding the above stated quantities or allowances. The Contractor shall not mark-up invoices associated with the Allowance items listed above. Services for these Allowances shall be provided by the entities indicated, not the Contractor or his subcontractors.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

3.3 SCHEDULE OF ALLOWANCES

A. Palmer 3A Project
   1. Allowance No. 1: Testing Allowance:
      a. Include the not to exceed sum as indicated in the Proposal for material testing services including, but not limited to, concrete, steel reinforcement, soil bearing capacity, and soil/aggregate compaction. Contractor shall make all arrangements and provide coordination for this work.
   2. Allowance No. 2: Gas and Electric Utilities Allowance:
      a. Include the not to exceed sum as indicated in the Proposal for services to be paid to the power and gas providers to relocate and upgrade services to the site as required. Contractor shall coordinate all work with utility companies.
   3. Allowance No. 3: Permit Fees Allowance:

a. Include the not to exceed sum as indicated in the Proposal to compensate authorities for their efforts to review the construction plans for permit issuance, process the permit, and inspect Work.

4. Inspector Days

a. It shall be the responsibility of the bidder to include as a bid item in his proposal the number of inspection days he estimates will be required to complete this project. An inspector day shall be determined from the tabulation listed below for the time each inspector spends on the project. An inspector will be assigned to each work until carrying out separate operations needed to complete this project. This will be for, but not limited to, operations such as, while materials are being installed, during excavation and back-filling operations, all pressure tests, infiltration tests, T.V. inspection, placing concrete or asphalt paving, restoration operations, final inspection of the completed work or the checking of complaints on the project.

Delays in the progress of the work under the contract because of the Contractor's failure to diligently pursue his work will not eliminate an inspection fee being charges against the Contractor. Inspection time may be charged to the Contract for each day for the availability of an inspector on the project. This time may be charged against a Contractor until such time as the Contractor is ready for final payment. Charges for each inspector assigned to the project shall be made in accordance with the following schedule:

	Inspector Hours Chargeable
1. For any working day of less than four (4) hours	4
2. For a working day Monday through Friday inclusive of more than four (4) but less than eight (8) hours	8
3. For each working hour of fraction thereof in excess of eight (8) hours Monday through Friday inclusive and each working hour of fraction thereof on Saturday	1.25
4. For each working hour or fraction thereof on Sunday	1.50

An inspector day shall then be computed by adding the above listed total chargeable hours and dividing such total number of chargeable hours by eight (8).

When the Contractor elects not to work, the minimum show-up time for each inspector on the project shall be four (4) hours. No show-up time will be included when the Contractor gives the project engineer at least 24 hours notice of his intent not to work. The Contractor shall give the Engineer at least 48 hours notice before beginning each operation such as installing materials or restoration operations.

Provisions have been made on the itemized price schedule for the insertion of the number of inspector days anticipated for completion of the project. The Contractor shall insert the number of inspector days, multiply by Two Hundred Dollars ($680.00) per day and insert the total in the space provided. This total is a lump sum amount, which will be credited to the Contractor. The number of inspector days each month will be computed and the cost deducted from this credit amount. Should the credited amount become depleted, the cost of inspector days will continue to be deducted from the monthly payments to the Contractor. Upon completion of this project, any surplus remaining in the inspector day lump sum bid will be given to the Contractor.

The number of inspection days stated in the proposal will not be changed except by the authorized Change Order(s). An extension of time, if granted will not automatically constitute additional inspection days under the Contract.

B. Juniper Project

1. Allowance No. 1: Testing Allowance:
   a. Include the not to exceed sum as indicated in the Proposal for material testing services including, but not limited to, concrete, steel reinforcement, soil bearing capacity, and soil/aggregate compaction. Contractor shall make all arrangements and provide coordination for this work.
2. Allowance No. 2: Gas and Electric Utilities Allowance:
   a. Include the not to exceed sum as indicated in the Proposal for services to be paid to the power and gas providers to relocate and upgrade services to the site as required. Contractor shall coordinate all work with utility companies.
3. Allowance No. 3: Permit Fees Allowance:
   a. Include the not to exceed sum as indicated in the Proposal to compensate authorities for their efforts to review the construction plans for permit issuance, process the permit, and inspect Work.
4. Inspector Days
   a. It shall be the responsibility of the bidder to include as a bid item in his proposal the number of inspection days he estimates will be required to complete this project. An inspector day shall be determined from the tabulation listed below for the time each inspector spends on the project. An inspector will be assigned to each work until carrying out separate operations needed to complete this project. This will be for, but not limited to, operations such as, while materials are being installed, during excavation and back-filling operations, all pressure tests, infiltration tests, T.V. inspection, placing concrete or asphalt paving, restoration operations, final inspection of the completed work or the checking of complaints on the project.

      Delays in the progress of the work under the contract because of the Contractor's failure to diligently pursue his work will not eliminate an inspection fee being charges against the Contractor. Inspection time may be charged to the Contract for each day for the availability of an inspector on the project. This time may be charged against a Contractor until such time as the Contractor is ready for final payment. Charges for each inspector assigned to the project shall be made in accordance with the following schedule:

	Inspector Hours Chargeable
1. For any working day of less than four (4) hours	4
2. For a working day Monday through Friday inclusive of more than four (4) but less than eight (8) hours	8
3. For each working hour of fraction thereof in excess of eight (8) hours Monday through Friday inclusive and each working hour of fraction thereof on Saturday	1.25
4. For each working hour or fraction thereof on Sunday	1.50

      An inspector day shall then be computed by adding the above listed total chargeable hours and dividing such total number of chargeable hours by eight (8).

      When the Contractor elects not to work, the minimum show-up time for each inspector on the project shall be four (4) hours. No show-up time will be included

when the Contractor gives the project engineer at least 24 hours notice of his intent not to work. The Contractor shall give the Engineer at least 48 hours notice before beginning each operation such as installing materials or restoration operations.

Provisions have been made on the itemized price schedule for the insertion of the number of inspector days anticipated for completion of the project. The Contractor shall insert the number of inspector days, multiply by Two Hundred Dollars ($680.00) per day and insert the total in the space provided. This total is a lump sum amount, which will be credited to the Contractor. The number of inspector days each month will be computed and the cost deducted from this credit amount. Should the credited amount become depleted, the cost of inspector days will continue to be deducted from the monthly payments to the Contractor. Upon completion of this project, any surplus remaining in the inspector day lump sum bid will be given to the Contractor.

The number of inspection days stated in the proposal will not be changed except by the authorized Change Order(s). An extension of time, if granted will not automatically constitute additional inspection days under the Contract.

END OF SECTION 01 21 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.2 MINOR CHANGES IN THE WORK

A. Engineer will issue Field Orders, authorizing changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Engineer will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
   1. Work Change Proposal Requests issued by Engineer are not instructions either to stop work in progress or to execute the proposed change.
   2. Within 20 days, when not otherwise specified after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
      a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
      b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      c. Include costs of labor and supervision directly attributable to the change.
      d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
      e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or forms acceptable to Engineer.

B. Contractor-Initiated Work Change Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer.
   1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
   2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
   3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
   4. Include costs of labor and supervision directly attributable to the change.
   5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Work Change Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or a form acceptable to Engineer.

1.4 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.5 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Engineer will issue a Change Order for signatures of Owner and Contractor on a Change Order form provided by the Engineer.

1.6 WORK CHANGE DIRECTIVE

A. Work Change Directive: Engineer may issue a Work Change Directive on EJCDC Document C-940. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
   1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   2. Section 01 31 00 "Project Management and Coordination" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.2 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
   1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:
      a. Application for Payment forms with continuation sheets.
      b. Submittal schedule.
      c. Items required to be indicated as separate activities in Contractor's construction schedule.
   2. Submit the schedule of values to Engineer at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
   3. Sub-schedules for Phased Work: Where the Work is separated into phases requiring separately phased payments, provide sub-schedules showing values coordinated with each phase of payment.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.
   1. Identification: Include the following Project identification on the schedule of values:
      a. Project name and location.
      b. Name of Engineer
      c. Engineer’s project number.
      d. Contractor's name and address.
      e. Date of submittal.
   2. Arrange schedule of values consistent with format of EJCDC Document C-620.
   3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
      a. Include separate line items under principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
   4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
   5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
      a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
   6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.

7. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.
8. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Engineer and paid for by Owner.
    1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: Submit Application for Payment to Engineer by the day of the month agreed upon with the Owner. The period covered by each Application for Payment is one month, ending on the agreed upon day of month.

C. Contractor’s Declaration Form: Each application shall be accompanied by a Contractor’s Declaration on the form provided in the project manual.

D. Application for Payment Forms: Use EJCDC Document C-620 as form for Applications for Payment.

E. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.
    1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
    2. Include amounts of Change Orders, Work Change Directives and Construction Change Directives issued before last day of construction period covered by application.

F. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Engineer by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
    1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
    1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
    2. When an application shows completion of an item, submit conditional final or full waivers.
    3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
    4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.
    5. Submit final application for payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).
4. Schedule of unit prices.
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of building permits.
9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
10. Initial progress report.
11. Report of preconstruction conference.
12. Certificates of insurance and insurance policies.

I. Application for Payment at Substantial Completion: After Engineer issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
   1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
   2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
   1. Evidence of completion of Project closeout requirements.
   2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
   3. Updated final statement, accounting for final changes to the Contract Sum.
   4. 00 65 19.13 "Contractor's Affidavit"
   5. 00 65 20 “Contractor’s Declaration”
   6. AIA Document G707-1994, "Consent of Surety to Final Payment."
   7. Evidence that claims have been settled.
   8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
   9. Final liquidated damages settlement statement.
   10. Releases from the public agencies from which permits have been obtained for Work under this agreement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. Coordination drawings.
   2. Requests for Information (RFIs).
   3. Project Web site.
   4. Project meetings.

B. Related Requirements:
   1. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.2 DEFINITIONS

A. RFI: Request from Contractor seeking information required by or clarifications of the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design with 24 hours of receipt of bids. Use CSI Form 1.5A or similar. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

1.4 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections that depend on each other for proper installation, connection, and operation.
   1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
   2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
   1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts

and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Coordination with Owner and other contractors: The Owner, utility companies, and commercial or private owners may have construction projects occurring within or adjacent to the project limits during the life of this contract. Coordinate construction with all such projects that may be ongoing in the vicinity. Where the Contractor's work affects the operation of the Owner's utilities, coordinate work with the Owner. Contact Owner's representative. Give at least 48 hours of notice to the Owner in order to schedule activities such as valve operation, hydrant operation, sewer and structure cleanout, and similar items of work. No claim for extra compensation or adjustments in the contract prices will be allowed on account of delay or failure of others to complete the work scheduled.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
    a. Indicate functional and spatial relationships of components of Architectural, structural, civil, mechanical, and electrical systems.
    b. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Engineer indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show Architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Engineer will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.6 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Engineer will return RFIs submitted to Engineer by other entities controlled by Contractor with no response.
   2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Engineer
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.
   9. Drawing number and detail references, as appropriate.
   10. Field dimensions and conditions, as appropriate.
   11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
   12. Contractor's signature.
   13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
   14. Space for Engineer’s response.

C. RFI Forms: AIA Document G716 or software generated form with substantially the same content as indicated above, acceptable to Engineer.

D. Engineer’s Action: Engineer will review each RFI, determine action required, and respond. Allow seven working days for Engineer’s response for each RFI. RFIs received by Engineer after 1:00 p.m. will be considered as received the following working day.
   1. The following RFIs will be returned without action:
      a. Requests for approval of submittals.
      b. Requests for approval of substitutions.
      c. Requests for coordination information already indicated in the Contract Documents.
      d. Requests for adjustments in the Contract Time or the Contract Sum.
      e. Requests for interpretation of Engineer’s actions on submittals.
      f. Incomplete RFIs or inaccurately prepared RFIs.
   2. Engineer’s action may include a request for additional information, in which case Engineer's time for response will date from time of receipt of additional information.
   3. Engineer’s action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 01 26 00 "Contract Modification Procedures."
      a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer in writing within 10 days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log at each construction progress meeting. Use CSI Log Form 13.2B or similar form. Include the following:
   1. Project name.
   2. Name and address of Contractor.
   3. Name and address of Engineer.

4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date Engineer's response was received.

F. On receipt of Engineer's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Engineer's within seven days if Contractor disagrees with response.
   1. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.7 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
   1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times.
   2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
   3. Minutes: record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Engineer, within three days of the meeting.

B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than 15 days after execution of the Agreement.
   1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Phasing.
      c. Critical work sequencing and long-lead items.
      d. Designation of key personnel and their duties.
      e. Procedures for processing field decisions and Change Orders.
      f. Procedures for RFIs.
      g. Procedures for testing and inspecting.
      h. Procedures for processing Applications for Payment.
      i. Distribution of the Contract Documents.
      j. Submittal procedures.
      k. Preparation of record documents.
      l. Use of the premises
      m. Use of existing building if Contractor will need access to a building.
      n. Work restrictions.
      o. Working hours.
      p. Owner's occupancy requirements.
      q. Responsibility for temporary facilities and controls.
      r. Procedures for moisture and mold control.
      s. Procedures for disruptions and shutdowns.
      t. Construction waste management and recycling.
      u. Parking availability.
      v. Office, work, and storage areas.
      w. Equipment deliveries and priorities.
      x. First aid.
      y. Security.

z. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Engineer of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.
      b. Options.
      c. Related RFIs.
      d. Related Change Orders.
      e. Purchases.
      f. Deliveries.
      g. Submittals.
      h. Review of mockups.
      i. Possible conflicts.
      j. Compatibility problems.
      k. Time schedules.
      l. Weather limitations.
      m. Manufacturer's written instructions.
      n. Warranty requirements.
      o. Compatibility of materials.
      p. Acceptability of substrates.
      q. Temporary facilities and controls.
      r. Space and access limitations.
      s. Regulations of authorities having jurisdiction.
      t. Testing and inspecting requirements.
      u. Installation procedures.
      v. Coordination with other work.
      w. Required performance results.
      x. Protection of adjacent work.
      y. Protection of construction and personnel.
   3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
   4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
   5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: Conduct progress meetings at bi-weekly intervals.
   1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to

Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Progress cleaning.
10) Quality and work standards.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Pending claims and disputes.
18) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

1.8 PROGRES SCHEDULE

A. DEFINITIONS

1. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.
   a. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
   b. Predecessor Activity: An activity that precedes another activity in the network.
   c. Successor Activity: An activity that follows another activity in the network.
2. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
3. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
4. Float: The measure of leeway in starting and completing an activity.
   a. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.

B. INFORMATIONAL SUBMITTALS

1. Format for Submittals: Submit required submittals in the following format:
   a. Working electronic copy of schedule file, where indicated.
   b. PDF electronic file.
2. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

a. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

3. Construction Schedule Updating Reports: Submit with Applications for Payment.
4. Daily Construction Reports: Submit at weekly intervals.
5. Site Condition Reports: Submit at time of discovery of differing conditions.

C. COORDINATION
1. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
a. Secure time commitments for performing critical elements of the Work from entities involved.
b. Coordinate each construction activity in the network with other activities and schedule them in proper sequence

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.
1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work.
1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Engineer.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 45 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Engineer administrative procedures necessary for certification of Substantial Completion.
6. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
1. Phasing: Arrange list of activities on schedule by phase.
2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
3. Work Restrictions: Show the effect of the following items on the schedule:
a. Coordination with existing construction.
b. Limitations of continued occupancies.
c. Uninterruptible services.
d. Partial occupancy before Substantial Completion.
e. Use of premises restrictions.
f. Provisions for future construction.

g. Seasonal variations.
h. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion**.**

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

F. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule.

G. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days of date established for the Notice of Award.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require three months or longer to complete, indicate an estimated completion percentage in 10 percent increments within time bar.

2.3 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Work Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.

19. Substantial Completions authorized.

B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.
   1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
   2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
   3. As the Work progresses, indicate final completion percentage for each activity.

B. Distribution: Distribute copies of approved schedule to Engineer, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
   1. Post copies in Project meeting rooms and temporary field offices.
   2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 01 31 00

SECTION 01 32 33 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for the following:
   1. Preconstruction video recording.

B. Related Requirements:
   1. Section 01 77 00 "Closeout Procedures" for submitting photographic documentation as Project Record Documents at Project closeout.

1.2 INFORMATIONAL SUBMITTALS

A. Key Plan: Submit key plan of Project site and adjoining parcels with notation of vantage points marked for location and direction of each video recording. Indicate elevation or story of construction. Include same information as corresponding photographic documentation.

B. Video Recordings: Submit video recordings within seven days of recording.
   1. Submit video recordings on thumb drive or by uploading to web-based project software site. Include copy of key plan indicating each video's location and direction.
   2. Identification: With each submittal, provide the following information in file metadata tag or on web-based project software site depending on submittal method:
      a. Name of Project.
      b. Name and address of photographer.
      c. Name of Engineer.
      d. Name of Contractor.
      e. Date video recording was recorded.
      f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
   3. Transcript: Prepared on 8-1/2-by-11-inchpaper, punched and bound in three-ring binders. Provide label on front and spine. Include a cover sheet with label information. Include name of Project and date of video recording on each page.

1.3 FORMATS AND MEDIA

A. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode with vibration-reduction technology. Provide supplemental lighting in low light levels or backlit conditions.

B. Metadata: Record accurate date and time and GPS location data from camera.

C. File Names: Name media files with date and sequential numbering suffix.

1.4 CONSTRUCTION VIDEO RECORDINGS

A. Video Recording Photographer: Engage a qualified videographer to record construction video recordings.

B. Narration: Describe scenes on video recording by audio narration by microphone while video recording is recorded. Include description of items being viewed, existing conditions, recent events, and planned activities. At each change in location, describe vantage point, location, direction (by compass point), and elevation or story of construction.
   1. Confirm date and time at beginning and end of recording.
   2. Begin each video recording with name of Project, Contractor's name, videographer's name, and Project location.

C. Transcript: Provide a typewritten transcript of the narration. Display images and running time captured from video recording opposite the corresponding narration segment.

D. Preconstruction Video Recording: Before starting construction, record video recording of Project site and surrounding properties from different vantage points, as directed by Engineer.
   1. Flag construction limits before recording construction video recordings.
   2. Show existing conditions adjacent to Project site before starting the Work.
   3. Show existing homes or residences either on or adjoining Project site to accurately record physical conditions at the start of construction, including ones facing construction (east) and behind the Project site (west). Also record physical conditions of interior of existing wet well.
   4. Show protection efforts by Contractor.

1.5 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner for unlimited reproduction of photographic documentation.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in JPG format, with minimum size of 8 megapixels.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 32 33

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:
   1. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
   2. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.2 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action.

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements.

1.3 SUBMITTALS SCHEDULE

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.

1.4 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Engineer's Digital Data Files: Electronic copies of digital data files of the Contract Drawings will not be provided by Engineer for Contractor's use in preparing submittals.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   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.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. 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.
   1. Initial Review: Allow 21 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.

2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 21 days for review of each resubmittal.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
   1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
   2. Name file with submittal number or other unique identifier, including revision identifier.
      a. File name shall use Specification Section number followed by a decimal point and then a sequential number (e.g., Submittal 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., Submittal 06 10 00.01.A).
   3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
   4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:
      a. Project name.
      b. Date.
      c. Name and address of Engineer.
      d. Name of Construction Manager.
      e. Name of Contractor.
      f. Name of firm or entity that prepared submittal.
      g. Names of subcontractor, manufacturer, and supplier.
      h. Category and type of submittal.
      i. Submittal purpose and description.
      j. Specification Section number and title.
      k. Specification paragraph number or drawing designation and generic name for each of multiple items.
      l. Drawing number and detail references, as appropriate.
      m. Location(s) where product is to be installed, as appropriate.
      n. Related physical samples submitted directly.
      o. Indication of full or partial submittal.
      p. Transmittal number**,** numbered consecutively.
      q. Submittal and transmittal distribution record.
      r. Other necessary identification.
      s. Remarks.
   5. Metadata: Include the following information as keywords in the electronic submittal file metadata:
      a. Project name.
      b. Number and title of appropriate Specification Section.
      c. Manufacturer name.
      d. Product name.
   6. American Iron and Steel (AIS) Certification:
      a. Contractor shall provide written Certification Letter and/or STEP Certification Process Letter with each submittal if required by AIS provisions. Certification letter shall include the following items:
         1) What is the product.
         2) Where the product was made.
         3) To whom was the product delivered.
         4) Signature of company representative(s).
         5) Reference to AIS requirements.
      b. Products that do not require AIS certifications shall be provided with a written certification letter on why the product does not need to comply.
      c. Contractor shall acquire and review all supplier/manufacturer/fabricator certification letters for compliance.

d. Contractor shall maintain up to date AIS product spreadsheet.

E. Options: Identify options requiring selection by Engineer.

F. Deviations: Clearly identify any deviations from the Contract Documents on submittals both in writing and by highlighting in the submittal text or product data, on the submittal drawings or both.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements:
1. Submit electronic submittals via email as PDF electronic files.
a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
2. Action Submittals: Submit electronic copies of each submittal unless otherwise indicated. Engineer will return one copy.
3. Informational Submittals: Submit electronic copies of each submittal unless otherwise indicated. Engineer will not return copies.
4. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
a. Provide a digital signature with digital certificate on electronically-submitted certificates and certifications where indicated.
b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

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 published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
a. Manufacturer's catalog cuts.
b. Manufacturer's product specifications.
c. Standard color charts.
d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.

g. Notation of coordination requirements.
h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:
   a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
   1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
      a. Identification of products.
      b. Schedules.
      c. Compliance with specified standards.
      d. Notation of coordination requirements.
      e. Notation of dimensions established by field measurement.
      f. Relationship and attachment to adjoining construction clearly indicated.
      g. Seal and signature of professional engineer if specified.
   2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches. Text shall be readable on the size of the drawing provided.
   3. Submit Shop Drawings in the following format:
      a. PDF electronic file.

D. Coordination Drawings Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

E. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

F. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures.

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

P. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

Q. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

R. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

S. Design Data: 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. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by an Engineer are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Engineer.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible Engineer, for each product and system specifically assigned to Contractor to be designed or certified by an Engineer.
   1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer. Do not use red for stamps, markings or annotations. Engineer's comments and annotations will be in red.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. 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.

3.2 DESIGN PROFESSIONAL'S ACTION

A. General: Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action, as follows:
   1. Approved.
   2. Rejected.
   3. Approved as Noted
   4. Revise and Resubmit.
   5. Submit Specified Item.
   6. Acknowledge Receipt.

C. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to appropriate party.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded or returned to Contractor marked "Not Required For Review."

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   2. Requirements for Contractor to provide quality-assurance and -control services required by Engineer, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
   3. Specific test and inspection requirements are not specified in this Section.

1.2 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Engineer.

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 REGULATORY

A. Public Agency Requirements: It is the intention of these specifications to construct all work in accordance with the applicable requirements of the Owner, the Michigan Department of Environment, Great Lakes, and Energy, and City of Owosso, the contract specifications, and the contract drawings. Where there is a conflict between any of the aforementioned specifications, and the permit requirements for the agency having jurisdiction, the more restrictive shall govern.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
   1. Date of issue.
   2. Project title and number.
   3. Name, address, and telephone number of testing agency.
   4. Dates and locations of samples and tests or inspections.
   5. Names of individuals making tests and inspections.
   6. Description of the Work and test and inspection method.
   7. Identification of product and Specification Section.
   8. Complete test or inspection data.
   9. Test and inspection results and an interpretation of test results.
   10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
   11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
   12. Name and signature of laboratory inspector.
   13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative’s Field Reports: Prepare written information documenting tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      d. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer**,** with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
      a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
   2. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a manufacturer's representative to observe and inspect the Work. Manufacturer's representative's services include examination of substrates and conditions, verification of materials, inspection of completed portions of the Work, and submittal of written reports.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Engineer and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Engineer and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Contractor Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and as follows:
1. Notifying Engineer and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
2. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer with copy to Contractor and to authorities having jurisdiction.
3. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
4. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
5. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer reference during normal working hours.
   1. Submit log at project closeout as part of the project record documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
   1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer’s action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."

B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
   1. AABC - Associated Air Balance Council; www.aabc.com.
   2. AAMA - American Engineerural Manufacturers Association; www.aamanet.org.
   3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
   4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
   5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
   6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
   7. ABMA - American Boiler Manufacturers Association; www.abma.com.
   8. ACI - American Concrete Institute; (Formerly: ACI International); www.abma.com.
   9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
   10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
   11. AF&PA - American Forest & Paper Association; www.afandpa.org.
   12. AGA - American Gas Association; www.aga.org.
   13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
   14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
   15. AI - Asphalt Institute; www.asphaltinstitute.org.
   16. AIA - American Institute of Engineers (The); www.aia.org.
   17. AISC - American Institute of Steel Construction; www.aisc.org.
   18. AISI - American Iron and Steel Institute; www.steel.org.
   19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
   20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
   21. ANSI - American National Standards Institute; www.ansi.org.
   22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
   23. APA - APA - The Engineered Wood Association; www.apawood.org.
   24. APA - Engineerural Precast Association; www.archprecast.org.
   25. API - American Petroleum Institute; www.api.org.
   26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
   27. ARI - American Refrigeration Institute; (See AHRI).
   28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
   29. ASCE - American Society of Civil Engineers; www.asce.org.
   30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
   31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
   32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
   33. ASSE - American Society of Safety Engineers (The); www.asse.org.
   34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
   35. ASTM - ASTM International; www.astm.org.
   36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
   37. AWEA - American Wind Energy Association; www.awea.org.
   38. AWI - Engineerural Woodwork Institute; www.awinet.org.
   39. AWMAC - Engineerural Woodwork Manufacturers Association of Canada; www.awmac.com.
   40. AWPA - American Wood Protection Association; www.awpa.com.
   41. AWS - American Welding Society; www.aws.org.
   42. AWWA - American Water Works Association; www.awwa.org.
   43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.

44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CEA - Canadian Electricity Association; www.electricity.ca.
51. CEA - Consumer Electronics Association; www.ce.org.
52. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
53. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
54. CGA - Compressed Gas Association; www.cganet.com.
55. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
56. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
57. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
58. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
59. CPA - Composite Panel Association; www.pbmdf.com.
60. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
61. CRRC - Cool Roof Rating Council; www.coolroofs.org.
62. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
63. CSA - Canadian Standards Association; www.csa.ca.
64. CSA - CSA International; (Formerly: IAS - International Approval Services); www.csa-international.org.
65. CSI - Construction Specifications Institute (The); www.csinet.org.
66. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
67. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
68. CWC - Composite Wood Council; (See CPA).
69. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
70. DHI - Door and Hardware Institute; www.dhi.org.
71. ECA - Electronic Components Association; (See ECIA).
72. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
73. ECIA - Electronic Components Industry Association; www.eciaonline.org.
74. EIA - Electronic Industries Alliance; (See TIA).
75. EIMA - EIFS Industry Members Association; www.eima.com.
76. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
77. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
78. ESTA - Entertainment Services and Technology Association; (See PLASA).
79. EVO - Efficiency Valuation Organization; www.evo-world.org.
80. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
81. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
82. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
83. FM Approvals - FM Approvals LLC; www.fmglobal.com.
84. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
85. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
86. FSA - Fluid Sealing Association; www.fluidsealing.com.
87. FSC - Forest Stewardship Council U.S.; www.fscus.org.
88. GA - Gypsum Association; www.gypsum.org.
89. GANA - Glass Association of North America; www.glasswebsite.com.
90. GS - Green Seal; www.greenseal.org.
91. HI - Hydraulic Institute; www.pumps.org.
92. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
93. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).

94. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
95. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
96. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
97. IAS - International Accreditation Service; www.iasonline.org.
98. IAS - International Approval Services; (See CSA).
99. ICBO - International Conference of Building Officials; (See ICC).
100. ICC - International Code Council; www.iccsafe.org.
101. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
102. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
103. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
104. IEC - International Electrotechnical Commission; www.iec.ch.
105. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
106. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
107. IESNA - Illuminating Engineering Society of North America; (See IES).
108. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
109. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
110. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.
111. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
112. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
113. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
114. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
115. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
116. ISO - International Organization for Standardization; www.iso.org.
117. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
118. ITU - International Telecommunication Union; www.itu.int/home.
119. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
120. LMA - Laminating Materials Association; (See CPA).
121. LPI - Lightning Protection Institute; www.lightning.org.
122. MBMA - Metal Building Manufacturers Association; www.mbma.com.
123. MCA - Metal Construction Association; www.metalconstruction.org.
124. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
125. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
126. MHIA - Material Handling Industry of America; www.mhia.org.
127. MIA - Marble Institute of America; www.marble-institute.com.
128. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
129. MPI - Master Painters Institute; www.paintinfo.com.
130. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
131. NAAMM - National Association of Engineerural Metal Manufacturers; www.naamm.org.
132. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
133. NADCA - National Air Duct Cleaners Association; www.nadca.com.
134. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
135. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
136. NBI - New Buildings Institute; www.newbuildings.org.
137. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
138. NCMA - National Concrete Masonry Association; www.ncma.org.
139. NEBB - National Environmental Balancing Bureau; www.nebb.org.
140. NECA - National Electrical Contractors Association; www.necanet.org.
141. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
142. NEMA - National Electrical Manufacturers Association; www.nema.org.
143. NETA - InterNational Electrical Testing Association; www.netaworld.org.

144. NFHS - National Federation of State High School Associations; www.nfhs.org.
145. NFPA - National Fire Protection Association; www.nfpa.org.
146. NFPA - NFPA International; (See NFPA).
147. NFRC - National Fenestration Rating Council; www.nfrc.org.
148. NHLA - National Hardwood Lumber Association; www.nhla.com.
149. NLGA - National Lumber Grades Authority; www.nlga.org.
150. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
151. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
152. NRCA - National Roofing Contractors Association; www.nrca.net.
153. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
154. NSF - NSF International; www.nsf.org.
155. NSPE - National Society of Professional Engineers; www.nspe.org.
156. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
157. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
158. NWFA - National Wood Flooring Association; www.nwfa.org.
159. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
160. PDI - Plumbing & Drainage Institute; www.pdionline.org.
161. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
162. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
163. RFCI - Resilient Floor Covering Institute; www.rfci.com.
164. RIS - Redwood Inspection Service; www.redwoodinspection.com.
165. SAE - SAE International; www.sae.org.
166. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
167. SDI - Steel Deck Institute; www.sdi.org.
168. SDI - Steel Door Institute; www.steeldoor.org.
169. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
170. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
171. SIA - Security Industry Association; www.siaonline.org.
172. SJI - Steel Joist Institute; www.steeljoist.org.
173. SMA - Screen Manufacturers Association; www.smainfo.org.
174. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
175. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
176. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
177. SPIB - Southern Pine Inspection Bureau; www.spib.org.
178. SPRI - Single Ply Roofing Industry; www.spri.org.
179. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
180. SSINA - Specialty Steel Industry of North America; www.ssina.com.
181. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
182. STI - Steel Tank Institute; www.steeltank.com.
183. SWI - Steel Window Institute; www.steelwindows.com.
184. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
185. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
186. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
187. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
188. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
189. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
190. TMS - The Masonry Society; www.masonrysociety.org.
191. TPI - Truss Plate Institute; www.tpinst.org.
192. TPI - Turfgrass Producers International; www.turfgrasssod.org.
193. TRI - Tile Roofing Institute; www.tileroofing.org.
194. UL - Underwriters Laboratories Inc.; www.ul.com.

195. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
196. USAV - USA Volleyball; www.usavolleyball.org.
197. USGBC - U.S. Green Building Council; www.usgbc.org.
198. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
199. WASTEC - Waste Equipment Technology Association; www.wastec.org.
200. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
201. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
202. WDMA - Window & Door Manufacturers Association; www.wdma.com.
203. WI - Woodwork Institute; www.wicnet.org.
204. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
205. WWPA - Western Wood Products Association; www.wwpa.org.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. DIN - Deutsches Institut fur Normung e.V.; www.din.de.
2. IAPMO - International Association of Plumbing and Mechanical Officials; www.iapmo.org.
3. ICC - International Code Council; www.iccsafe.org.
4. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).

5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.
    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Engineerural & Transportation Barriers Compliance Board; (See USAB).

F. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list.
1. CBHF; State of California; Department of Consumer Affairs; Bureau of Electronic and Appliance Repair, Home Furnishings and Thermal Insulation; www.bearhfti.ca.gov.
2. CCR; California Code of Regulations; Office of Administrative Law; California Title 24 Energy Code; www.calregs.com.
3. CDHS; California Department of Health Services; (See CDPH).
4. CDPH; California Department of Public Health; Indoor Air Quality Program; www.cal-iaq.org.
5. CPUC; California Public Utilities Commission; www.cpuc.ca.gov.
6. EGLE; Michigan Department of Environment, Great Lakes, and Energy Quality; www.michigan.gov/deq
7. MDOT; Michigan Department of Transportation; www.michigan.gov/mdot
8. ODOT; Ohio Department of Transportation; www.dot.state.oh.us
9. Ohio EPA: Ohio Environmental Protection Agency; www.epa.state.oh.us
10. SCAQMD; South Coast Air Quality Management District; www.aqmd.gov.
11. TFS; Texas A&M Forest Service; Sustainable Forestry and Economic Development; www.txforestservice.tamu.edu.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

1.1 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:
   1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.2 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Engineer, testing agencies, and authorities having jurisdiction.

B. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
   1. Not available at Juniper site.

C. Electric Power Service from Existing System: Electric power from Owner’s existing system is not available for use. Contractor to provide their own electrical power (generator) as required for construction operations.

1.3 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire prevention program.

1.4 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.5 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel office activities and to accommodate Project meetings specified in other Division 01 Sections. Keep office clean and orderly.

C. Engineer's Field Equipment: Prior to mobilizing on the site, Contractor shall provide equipment for an Office for Owner's representative at a location in the WTP designated by Owner.
   1. The office shall be equipped with acceptable second-hand furniture as follows:
      a. Drawing table and stool
   2. Office shall remain on-site until final completion of the contract or as directed by Engineer.
   3. Upon completion of the contract, contractor shall remove all buildings, foundations, temporary utility services and debris.

D. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
   1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.
   1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Water Service: The Contractor shall not make a connection to any public water main or fire hydrant without first obtaining the necessary permit and/or meter from the Owner. Existing public water systems shall be operated and controlled by the Owner. All valves shall be operated exclusively by the Owner's personnel.
   1. Not available at Juniper site.

C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

D. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

E. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
   1. Install electric power service overhead unless otherwise indicated.
   2. Connect temporary service to Owner's existing power source, as directed by Owner.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
   1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:
   1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
   2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.
   1. Provide dust-control treatment that is nonpolluting and non-tracking. Reapply treatment as required to minimize dust.

C. Parking: Provide temporary parking areas for construction personnel.

D. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
   1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
   2. Remove snow and ice as required to minimize accumulations.

E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
   1. Identification Signs: Provide Project identification signs as indicated on Drawings.
   2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
      a. Provide temporary, directional signs for construction personnel and visitors.
   3. Maintain and touchup signs so they are legible at all times.

F. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with progress cleaning requirements in Section 01 73 00 "Execution."

G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
   1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

H. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.
   1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Access to sites
   1. Contractor and subcontractors to provide list of Authorized tradesmen.

B. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

C. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

D. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

F. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

G. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weather-tight enclosure for building exterior.
   1. Where heating or cooling is needed and permanent enclosure is not complete, insulate temporary enclosures.

H. Temporary Partitions: Provide controls to minimize dust or overspray from construction activities from leaving the site. Contractor responsible to repair damage to others form failure of temporary controls and means and methods.

I. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire prevention program.
   1. Prohibit smoking in construction areas.
   2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
   3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

J. Noise Restrictions: Generators, compressors, and other necessary equipment shall be equipped to keep the noise level below 68 dBA at the project site property lines.

3.5 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

3.6 AVAILABILITY OF LANDS AND USE OF PREMISES

A. Maintain construction operations within the Owner’s property boundaries, existing Rights of Way, and established construction easements for the project.

B. If deemed necessary to perform construction operations outside these boundaries, obtain written agreements with property owners or agencies that have jurisdiction.

C. Furnish the Owner and Engineer copies of all said written agreements prior to construction activities on these properties.

D. Until final restoration can be made, maintain affected areas, in a passable condition, including but not limited to:
1. Public roads
2. Driveways
3. Sidewalks
4. Parking areas
5. Picnic pavilion area parking and access
6. Lake access
7. Trail access

E. Provide emergency access to property within the vicinity for police, fire equipment or ambulance services.

3.7 CLEAN UP AND SITE WORK

A. The Contractor shall maintain the construction site in a condition that:
   1. Is conducive to proper execution of the Contract.
   2. Eliminates possible safety hazards.
   3. Minimizes the unpleasant aesthetics to the area residents.

B. Any damage to public or private property caused by the Contractor shall be repaired or corrected at the Contractor's expense.

C. Monitor and maintain the site continually throughout the course of the work.

D. Collect and deposit waste, rubbish and debris in a work site dumpster or roll-off box until removal.

E. Remove from the site, upon completion, the following:
   1. Rubbish and waste.
   2. Surplus materials.
   3. Construction debris.
   4. Equipment and tools.
   5. Machinery.

F. Leave the site clean and ready for use by the Owner and restore to original condition those portions of the site not designated for alteration by the Contract documents.
   1. Lawn Restoration
      a. Level and smooth ground surface to original condition.
      b. Import fertile, friable topsoil, containing a minimum of 2.5% and a maximum of 12% organic matter as determined by the Loss on Ignition Test with not more than 50% clay and not more than 55% sand as determined by ASTM D 422.
         1) Bring soil to friable condition by disking or harrowing to a depth of 3 to 4 inches. Apply fertilizer and seeding to soil in friable condition.
         2) Apply fertilizer uniformly to 500 pounds per acre.
         3) Work fertilizer in topsoil to a depth of 1 to 2 inches.
   2. At least 90% of the material shall pass the No. 10 sieve and shall be free of deleterious material larger than 1-inch in diameter.
   3. Material shall be free of refuse or material toxic to plant growth.
   4. Seed lawns per MDOT Class A.
      a. Apply seeding between April 20 to November 1.
      b. Hand rake all lawn areas.
      c. Sow lawn seed at 200 pounds per acre.
   5. Seed other areas per MDOT roadside.
      a. Sow other seed at 100 pounds per acre.
   6. Apply mulching to all seeded areas uniformly at 2-1/2 bales per 1000 square feet.

G. Conduct an inspection of all work areas, interior and exterior surfaces to verify that it is clean.

END OF SECTION 01 50 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:
   1. Construction layout.
   2. Field engineering and surveying.
   3. Installation of the Work.
   4. Cutting and patching.
   5. Coordination of Owner-installed products.
   6. Progress cleaning.
   7. Starting and adjusting.
   8. Protection of installed construction.

B. Related Requirements:
   1. Section 01 10 00 "Summary" for limits on use of Project site.
   2. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by either a land surveyor or professional engineer certifying that location and elevation of improvements comply with requirements.

B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.3 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.
   1. Structural Elements: When cutting and patching structural elements, notify Engineer of locations and details of cutting and await directions from Engineer before proceeding. Shore, brace, and support structural element during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection
   2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.
   3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.
   4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner

that would, in Engineer's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
   1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.
   1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
   2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.
   3. For protection of underground utilities in Michigan, contact “MISS DIG” at 1-800-482-7171 a minimum of three (3) working days prior to excavating. This does not relieve the Contractor of the responsibility of notifying utility owners who may not be part of the “MISS DIG” alert system.
   4. Where any utility, water, sewer, gas, telephone or any other public or private utilities are encountered, the Contractor must provide adequate protection for them, and he will be held responsible for any damages to such utilities arising from his operations.
   5. When it is apparent that construction operations may endanger the foundation of any utility, conduit, or support of any structure, the Contractor shall notify the utility owner of this possibility, and he shall take such steps as may be required to provide temporary bracing or support of conduits or structures.
   6. In all cases where permits or inspection fees are required by utilities in connection with changes to or temporary support of their conduits, the Contractor shall secure permits and pay all inspection fees.
   7. When it is necessary in order to carry out the Work that a pole, telephone or electric, be moved to a new location or moved and replaced after construction, the Contractor shall arrange for moving such pole or poles and the lines thereof, and shall pay any charges.
   8. Where it is the policy of any utility owner to make his own repairs to damaged conduit or other structures, the Contractor shall cooperate to the fullest extent with the utility owner and shall see that his operations interfere as little as possible with the utility owner’s operations.
   9. Sump Pump Discharge Pipe: Any discharge pipe from sump pumps or yard drains encountered on this project, whether or not shown on the plans, which discharges to existing ditches and/or storm sewers or across public or private easements, shall be

maintained, replaced, or reconnected as necessary. Bulkheads shall be placed only as approved by the Engineer. Sump pump connections shall be made to the storm drain pipe by a coring method as approved by the Engineer. The Contractor shall use adequate measures to prevent soil erosion, sedimentation, and/or ponding when connecting discharge pipes to existing or proposed ditches. This work shall be considered as incidental to the cost of the project.

10. Existing Sewer Facilities: Existing sewers or drains may be encountered along the line of work. In all such cases, the Contractor shall perform his operation in such a manner that sewer service will not be interrupted. He shall, at his own expense, make all temporary provisions to maintain sewer service (both dry weather and storm flows).
11. Unless otherwise indicated on the plans, the Contractor shall replace, at his own expense, any disturbed sewer or drain, or relay same at a new grade to be established by the Engineer such that sufficient clearance for the sewer will be provided.
12. Existing Water Facilities: Where existing water mains and/or water services are encountered in the work, they shall be maintained in operation. They shall be relayed if necessary using the class of pipe and fittings standard to the Owner of the main.
13. Existing Drains: Drainage through existing sewers, ditches and drains shall be maintained at all times during construction, and all nearby gutters shall be kept open for drainage.
14. Maintenance of services as described above shall be considered as incidental to the project cost unless pay items have been included in the bid form for this work.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
   1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
   2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
   3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. Refer to General Conditions Section 13. Lines and grades for principal layout work shall be performed by Owner and Engineer.

B. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer promptly.

C. General: Engage a land surveyor to lay out the Work using accepted surveying practices for layout work not specifically named in General Conditions Section 13.
   1. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
   2. Inform installers of lines and levels to which they must comply.
   3. Check the location, level and plumb, of every major element as the Work progresses.
   4. Notify Engineer when deviations from required lines and levels exceed allowable tolerances.
   5. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

D. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

E. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

F. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer.

3.4 FIELD ENGINEERING

A. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

B. Benchmarks: Establish and maintain a minimum of two permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.
   1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.

C. Certified Survey: On completion of foundation walls, major site improvements, and other required field engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
   1. Make vertical work plumb and make horizontal work level.

2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.
1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Engineer.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
   1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
   3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
   4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
   5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
   6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.
   1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
   2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
   5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weather-tight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.
   1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.

2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80℉.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Wash out area for trucks and equipment must be performed offsite or within Owner approved containment structure due to risk of well contamination.

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 DUST CONTROL

A. Maintain haul roads, detour roads, other public or private roads, driveways and parking lots in a dust free condition for the duration of the Contract.

B. Control dust by application of dust control materials and application methods as approved and as directed by the Engineer.

C. Dust control materials shall be applied as often as is necessary to control dust. Neglect of dust control will not be tolerated.

D. Should the Contractor be negligent of his duties in providing dust control, the Owner may, with or without notice cause the same to be done and deduct the cost of such work from any monies due or to become due to the Contractor under the Contract. Cost of providing dust control shall be considered incidental to the Work.

3.9 STREET CLEANING

A. Haul roads, detour roads, other public or private roads, driveways and parking lots will be kept clean and swept at regular intervals to maintain cleanliness.

B. Trucks hauling excavated material, cement, sand, stone or other loose materials from or to the site shall be tightly covered so that no spillage will occur on the adjacent streets. Before trucks start away from the site, their loads shall be trimmed and covered.

C. If, in the judgment of the Owner, adequate cleanup efforts are not being expended, including but not limited to, roadway, driveway and drainage maintenance, and removal of surplus materials, further construction shall be halted and work forces directed to the cleanup activity until proper order is restored. Should the Contractor continue to be negligent of his duties in maintaining proper street cleanliness, the Owner will take necessary steps to perform such cleaning and shall charge the Contractor for all costs.

3.10 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements"

3.11 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

C. Provide and maintain weather protection and heating at Contractor’s expense to properly protect the Work under construction from damage if the weather conditions require. This work shall include all windbreaks, insulation cover, land other necessary measures required to provide protection from freezing. Continue to provide weather protection and heating as necessary until such time as the Owner takes over the facility.

END OF SECTION 01 73 00

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:
   1. Record Drawings.
   2. Record Specifications.
   3. Record Product Data.

B. Related Requirements:
   1. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
   1. Number of Copies: Submit two sets of marked-up record prints.
      1) Submit PDF electronic files of scanned record prints and one set(s) of file prints.
      2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit one paper copy and one annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit one paper copy and one annotated PDF electronic files and directories of each submittal.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised Drawings as modifications are issued.
   1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
      a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
      b. Record data as soon as possible after obtaining it.
      c. Record and check the markup before enclosing concealed installations.
   2. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
   3. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
   4. Note Addenda, Construction or Work Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
   1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
   2. Format: per Owner requirements.
   3. Format: Annotated PDF electronic file with comment function enabled.
   4. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
   5. Refer instances of uncertainty to Engineer for resolution.
   6. Engineer will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
   1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
   2. Format: Annotated PDF electronic file with comment function enabled.
   3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
   4. Identification: As follows:
      a. Project name.
      b. Date.
      c. Designation "PROJECT RECORD DRAWINGS."
      d. Name of Engineer.
      e. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
   3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
   4. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
   1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
   2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
   3. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file or scanned PDF electronic file(s) of marked-up miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 02 41 16 - DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Demolition and removal of buildings, utilities and/or site features.
   2. Abandoning in-place and/or removing below-grade features.
   3. Disconnecting, capping or sealing, and abandoning in-place site utilities.

B. Related Requirements:
   1. Section 01 10 00 SUMMARY for use of the premises and phasing requirements.
   2. Section 01 73 00 EXECUTION for disposal and hauling requirements.
   3. Section 31 23 00 EXCAVATION AND FILL for subgrade preparation requirements.

1.2 DEFINITIONS

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

B. Remove and Salvage: Items of salvable value to Contractor may be removed from the structure as work progresses.

1.3 MATERIALS OWNERSHIP

A. Demolition waste becomes property of Contractor.

1.4 INFORMATIONAL SUBMITTALS

A. Site Health and Safety Plan
   1. See Section 01 3 5 .29 – Health, Safety, and Emergency Response Procedures

B. Work Plan: The Contractor shall submit a detailed account of the Contractor's approach to achieve all the goals of this work. The plan shall have a logical order of work items and specify projected time frames for each work item, at a minimum, the Work Plan shall include:
   1. Proposed methods of demolishing the structure.
   2. Methods proposed for general material removal and handling and waste handling.
   3. Certification of approved scales for measurement and payment processes.
   4. Proposed methods of abandoning and cutting and capping utilities.
   5. Manifesting procedures.
   6. Letter of Intent from the recycling/re-use facilities.
   7. Copies of solid Waste Disposal permits
   8. Transportation routes.
   9. List of Equipment/rental equipment to be used during the Scope of Work.
   10. Methods used to secure the site from vehicular and pedestrian traffic.
   11. Spill Control and contingency plans.
   12. Erosion Prevention and Sediment Control plans, including dust control operations.
   13. Fire Control.
   14. A site plan with marked locations of storage areas (including soil storage), barricades, and existing haul roads, as required to perform work.
   15. A list of names and telephones numbers of people who are on 24-hour call for the project duration. At a minimum, the list shall contain the names and telephone numbers of the

local police, local hospitals and ambulance, local fire department, other firms working with the Contractor and emergency response services.

16. A plan to protect the structures, public utilities, and pavements from construction activities by shoring, bracing, sheet piling, underpinning, or other methods required to prevent their failure for review. Any damage to pathway, sidewalk, curb and gutter, or other pavement due to Contractors construction activities shall be repaired at Contractors expense at no additional cost to the project. Reference the City of Ann Arbor Standard Specifications for local regulations.
17. A plan for the type and source of fill material proposed to fill in the excavation. The plan shall include the MDOT soil classification parameters of grain size, sieve analysis and organic content.
18. Methods for conducting other work under this contact

C. Schedule of Building Demolition Activities: Indicate the following:
   1. Detailed sequence of demolition work, with starting and ending dates for each activity.
   2. Temporary interruption of utility services.
   3. Shutoff and capping or re-routing of utility services.

D. Obtain all applicable permits, notifications and approvals and provide a copy of the approved permits to the Owner or Designee prior to commencing field work.

1.5 CLOSEOUT SUBMITTALS

A. Landfill records including, at a minimum, Disposal Records and Landfill permits may be required by Owner or Designee when discharging demolished materials that may or may not contain hazardous wastes.

B. Disposal Records: provide documentation of the receipt and acceptance of the waste by disposal facility licensed to accept each waste. Identify the quantity of waste received, description of each waste stream, and date received.

C. Statement of Refrigerant Recovery (if required): Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 FIELD CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Conditions of Structures: Owner assumes no responsibility for actual condition of structures to be demolished including removal of salvageable items through theft. Conditions existing at time of inspection for bidding purposes will be maintained by the Owner in so far as practicable. However, variations within structure may occur due to theft, vandalism, and weather-related stresses on the structures prior to start of demolition work.

C. Hazardous Materials or Other Items of Environmental Interest: May be present in buildings and structures to be demolished based on the age of the structures. To the extent required by law, the Contractor shall be responsible for identifying, quantifying, handling, and disposing of items of environmental interest that may be present. The Contractor is responsible for performing work in accordance with applicable regulations.

D. On-site storage or sale of removed items or materials is not permitted.

1.7 COORDINATION

A. Arrange demolition schedule with Owner and Engineer prior to start of work.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Contractor shall be an experienced firm that has successfully completed demolition Work similar to that indicated for this Project.

B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

C. Standards: Comply with ASSE A10.6 and NFPA 241.

2.2 SOIL MATERIALS

A. Comply with requirements in Section 31 2 0 .00 "Earth Moving."

PART 3 - EXECUTION

3.1 EXAMINATION

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

B. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

C. Asbestos Survey
1. An asbestos survey was commissioned by OHM-Advisors and was completed on November 30, 2022. Results are pending and will be released to bidders in an addendum.

D. Lead Survey
1. No suspected lead containing materials.

E. Universal Waste
1. No suspected universal waste.

F. Preparatory Removal (If Required)
1. To prepare for demolition, the Contractor will first remove all ACMs and other "packages" containing potentially hazardous materials, hazardous waste or/and universal waste. Those materials will be segregated and placed in appropriate containers for disposal/recycling.
2. Ensure that all utilities have been shut off and/or disconnected, as required by Contract Drawings.
3. Complete any other required pre-demolition preparation activities required by permit and/or regulations.

3.2 PREPARATION

A. Facility Remediation: If items of environmental interest are present at the site, the Contractor shall perform the following:

1. The Contractor shall utilize personnel that are adequate training, certified, and equipped with the handling of the items of environmental interest.
2. The Contractor shall properly dispose of or recycle these items of environmental interest in such a way that protects against water and air pollution and preserves natural resources during the execution of work included in this Contractor.
3. The Contractor will control operations to provide environmental protection in conformance with local, state, and federal regulations, permit and licenses.

3.3 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Utilities to be Disconnected: Locate, identify, disconnect, and seal or cap off utilities serving buildings and structures to be demolished.
   1. Owner will arrange to shut off water utilities when requested by Contractor. Water shut off by Owner will be at nearest upstream and downstream feed points of the wellhouse. All other utility shut offs shall be coordinated by the Contractor.
   2. Arrange to shut off utilities with utility companies.
      a. If the Contractor wishes to use existing utilities during execution of work, this shall be coordinated with the Owner. Contractor shall be required to pay for any utility permits and use of utilities, if necessary, during execution of work for this contract. Otherwise, the Contractor shall provide new temporary utilities.
      b. Contractor shall pay for disconnection fees.
      c. The Contractor shall be responsible for contacting each respective utility service. The Contractor shall be responsible to work with the utility companies to disconnect, abandon, or cut/cap utilities feeding the property. See Drawings for a listing of utility companies servicing the site.
      d. Contractor shall reference the Drawings for utility disconnect, abandonment, or cut/cap locations. These locations shall be field verified.
      e. Contractor to coordinate with power and gas utilities to relocate services to new structure.
   3. Unless otherwise directed, cut off pipe or conduit a minimum of 48inches below grade.
      a. Disconnect, cut and cap, and/or abandon-in-place specified utilities in accordance with regulating standards, utility owner's requirements, and standard construction practices.
         1) Contractor shall cut and cap at main supply line at property line or as otherwise directed in contract documents.
      b. Drain, purge, or otherwise remove, collect, and dispose of waters, wastewaters, chemicals, gases, explosives, acids, flammables, or other dangerous materials before proceeding with demolition operations.
      c. Cap, valve, or plug and seal (with compatible piping material) remaining portion of pipe or conduit according to requirements of authorities having jurisdiction.
   4. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

3.4 WELL ABANDONMENT

A. Qualified personnel: Palmer 3 well to be abandoned by licensed well driller per Michigan Groundwater Quality Control Rules R 325.1601 et. seq. adopted under Part 127, Water Supply and Sewer Systems, of the Public Health Code, 1978 PA 368, as amended (well code.)

B. Palmer 3 (wellogic well id 780 0000 07973.) is a 16-inch diameter well with a 12-inch diameter casing liner. The original depth of well is 146 feet prior to well collapse. The lower 20 feet to 30 feet is currently filled with loose sand, gravel, and clay debris. There is a hole in the casing approximately 5 feet above the well screen.

C. If the casing cannot be pulled, casing shall be cut off a minimum of 48-inches below grade or at a depth specified by above referenced rules and health code, whichever is deeper.

3.5 PROTECTION

A. Existing Facilities: Protect adjacent driveway and walkways during demolition operations.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.
   1. Strengthen or add new supports when required during progress of demolition.

C. Existing Utilities to Remain: Maintain utility services to remain and protect from damage during demolition operations.
   1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.

D. Temporary Protection: Erect temporary protection, such as walks, where required by authorities having jurisdiction and as indicated. Comply with requirements in Section 01 5 0 .00 "Temporary Facilities and Controls."
   1. Protect adjacent buildings and facilities from damage due to demolition activities.
   2. Protect existing site improvements, appurtenances, and landscaping to remain.
   3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent facilities to remain.

E. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.6 DEMOLITION, GENERAL

A. General: Demolish indicated buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
   1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
   2. Maintain fire watch during and for at least 24 hours after flame-cutting operations.
   3. Maintain adequate ventilation when using cutting torches.
   4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
   5. Walls and other parts of any building or structure shall not be left unguarded in such condition that such parts may fall, collapse or be weakened by wind pressure or vibration.
   6. Strictly segregate each type of debris (e.g., demolition debris, hazardous waste, solid waste, or other wastes).

B. Site Access and Temporary Controls: Conduct building demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
   1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic-ways if required by authorities having jurisdiction.
   2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

3.7 DEMOLITION BY MECHANICAL MEANS

A. Structure Demolition: Demolish all structures and foundations to extents shown on Drawings consistent with all applicable standards and regulations. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Below-Grade Demolition: Demolish foundation walls and other below-grade construction as indicated.
   1. Remove below-grade construction, including basements, foundation walls, and footings, to depths indicated.
   2. Fill in excavations, pits, trenches and depressions with acceptable materials per specifications.

C. Existing Utilities: Remove utilities as required by Drawings and Specifications.

3.8 SITE RESTORATION

A. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials, recycled pulverized concrete, recycled pulverized masonry according to backfill requirements in Section 31 2 0 .00 "Earth Moving."

B. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

3.9 REPAIRS

A. Promptly repair damage to adjacent facilities caused by demolition operations.

3.10 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved waste landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
   3. Debris shall be sized in accordance with the approved disposal facility requirements and placed into appropriate containers for off-site disposal at the approved disposal facility.
   4. The Contractor shall be responsible for:
      a. Debris and material characterization to determine regulatory-based disposal requirements.
      b. Selection and acceptance of the specified waste at an approved treatment or disposal facility.
      c. That the disposal facility is in compliance with its permit(s) at the time of waste disposal.
      d. That each type of debris and material is sufficiently characterized for disposal, as required by each disposal facility, to enable the Owner or his Designee, to sign disposal manifests, as required.
   5. Disposal of demolition debris:
      a. Demolition debris that will not be salvaged for recycle or reuse shall be disposed at a landfill permitted to accept demolition debris.
   6. Disposal of hazardous waste:
      a. If encountered, handling and disposing of hazardous waste material, including sampling and testing, shall be in strict accordance with 40 CFR 160. Hazardous

wastes shall be removed prior to commencing demolition. The Contractor is responsible for surveying the work area for hazardous wastes, including asbestos, prior to commencing demolition work.

7. Disposal of non-hazardous waste:
    a. Contaminated material not classified as hazardous shall be disposed of in accordance with RCRA Subtitle D.
8. Disposal of universal wastes:
    a. Universal wastes shall be disposed of/reclaimed in accordance with Universal Waste Regulations.

B. Do not burn demolished materials.

3.11 MANIFEST RECORDS

A. The Contractor shall originate, and provide transporter with copies of waste shipment manifests and/or bills of lading records for all wastes; verify wastes and quantities of each load shipped. The Contractor shall also provide the Owner or Designee with the original manifests to be retained for a 3-year period.

B. The manifest forms and records shall be consistent with the State of Michigan, US EPA, and U.S. DOT requirements.

C. The Owner or Designee will sign any required manifests. The Owner or Designee will review the manifest for completeness and accuracy prior to final release.

3.12 CLEANING

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

END OF SECTION 02 41 16

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel reinforcement bars.
   2. Welded-wire reinforcement.

B. Related Requirements:
   1. Section 03 38 16 "Unbonded Post-Tensioned Concrete" for reinforcing related to post-tensioned concrete.
   2. Section 03 41 00 "Precast Structural Concrete" for reinforcing used in precast structural concrete.
   3. Section 03 45 00 "Precast Architectural Concrete" for reinforcing used in precast architectural concrete.
   4. Section 32 13 13 "Concrete Paving" for reinforcing related to concrete pavement and walks.
   5. Section 32 13 16 "Decorative Concrete Paving" for reinforcing related to decorative concrete pavement and walks.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Each type of steel reinforcement.

B. Shop Drawings: Comply with ACI SP-066:
   1. Include placing drawings that detail fabrication, bending, and placement.
   2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
   3. For structural thermal break insulated connection system, indicate general configuration, insulation dimensions, tension bars, compression pads, shear bars, and dimensions.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For .

B. Welding certificates.
   1. Reinforcement To Be Welded: Welding procedure specification in accordance with AWS D1.4/D1.4M.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.4/D 1.4M.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Store reinforcement to avoid contact with earth.

2. Do not allow epoxy-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
3. Do not allow dual-coated reinforcement to be stored outdoors for more than 60 days without being stored under an opaque covering.
4. Do not allow stainless steel reinforcement to come into contact with uncoated reinforcement.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 , deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Steel Tie Wire: ASTM A1064/A1064M, annealed steel, not less than 0.0508 inch in diameter.
1. Finish: Plain .

2.4 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.

1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.
3. Weld reinforcing bars in accordance with AWS D1.4/D 1.4M, where indicated on Drawings.

G. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
1. Place joints perpendicular to main reinforcement.
2. Continue reinforcement across construction joints unless otherwise indicated.
3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length, to prevent concrete bonding to one side of joint.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.

B. Inspections:
1. Steel-reinforcement placement.
2. Steel-reinforcement welding.

C. Manufacturer's Inspections: Engage manufacturer of structural thermal break insulated connection system to inspect completed installations prior to placement of concrete, and to provide written report that installation complies with manufacturer's written instructions.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
1. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
2. Section 31 20 00 "Earth Moving" for drainage fill under slabs-on-ground.
3. Section 32 13 16 "Decorative Concrete Paving" for decorative concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Silica fume.
5. Aggregates.
6. Admixtures:
a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
7. Curing materials.
a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
8. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.

11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.7 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:
   1. Portland Cement: ASTM C150/C150M, Type I/II , gray .
   2. Fly Ash: ASTM C618, Class C or F.
   3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
   4. Silica Fume: ASTM C1240 amorphous silica.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Alkali-Silica Reaction: Comply with one of the following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
      b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
   2. Maximum Coarse-Aggregate Size: 1 inch nominal.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C330/C330M, 3/4-inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride in steel-reinforced concrete.
   1. Water-Reducing and -Retarding Admixture: ASTM C494/C494M, Type D.
   2. Non-Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

B. Water: Potable or complying with ASTM C1602/C1602M.

C. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.

2.4 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber .

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

2.5 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Slag Cement: 50 percent by mass.
   3. Silica Fume: 10 percent by mass.
   4. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
   5. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
   1. Use high-range water-reducing admixture in concrete, as required, for placement and workability.
   2. Use water-reducing and -retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
   3. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.6 CONCRETE MIXTURES

A. Class A : Normal-weight concrete used for footings, grade beams, and tie beams.
   1. Exposure Class: ACI 318 F1 .
   2. Minimum Compressive Strength: 4000 psi at 28 days.
   3. Maximum w/cm: 0.50 .
   4. Slump Limit: 4 inches , plus or minus 1 inch **<Insert limits>**.
   5. Air Content:
      a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size .
   6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

B. Class B : Normal-weight concrete used for foundation walls and concrete exposed to weather.
   1. Exposure Class: ACI 318 F2 F2
   2. Minimum Compressive Strength: 4500 psi at 28 days.
   3. Maximum w/cm: 0.45 .
   4. Slump Limit: 4 inches , plus or minus 1 inch .
   5. Air Content:
      a. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size .
   6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

C. Class C : Normal-weight concrete used for interior slabs-on-ground.
   1. Exposure Class: ACI 318 F0 .
   2. Minimum Compressive Strength: 4000 psi at 28 days.
   3. Maximum w/cm: 0.50 .
   4. Minimum Cementitious Materials Content: 470 lb/cu. yd. .
   5. Slump Limit: 4 inches , plus or minus 1 inch .

6. Air Content:
   a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
7. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.
8. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.0 lb/cu. yd. .

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
   2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
   1. Daily access to the Work.
   2. Incidental labor and facilities necessary to facilitate tests and inspections.
   3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
   4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
   1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
   3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.

3.4 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:

1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

C. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
   2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.
   3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
      a. Do not use vibrators to transport concrete inside forms.
      b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
      c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
      d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

F. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Do not place concrete floors and slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Maintain reinforcement in position on chairs during concrete placement.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Level concrete, cut high areas, and fill low areas.

6. Slope surfaces uniformly to drains where required.
7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
8. Do not further disturb slab surfaces before starting finishing operations.

3.6 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
   1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
      a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
      b. Remove projections larger than 1 inch.
      c. Tie holes do not require patching.
      d. Surface Tolerance: ACI 117 Class D.
      e. Apply to concrete surfaces not exposed to public view .

B. Related Unformed Surfaces:
   1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
   2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.7 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish:
   1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
   2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   4. Do not add water to concrete surface.
   5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
   6. Apply a trowel finish to surfaces exposed to view .
   7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
      a. Slabs on Ground:
         1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch .

3.8 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
   1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
   2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
   3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Equipment Bases and Foundations:
   1. Coordinate sizes and locations of concrete bases with actual equipment provided.

2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
3. Minimum Compressive Strength: 4500 psi at 28 days.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
6. Prior to pouring concrete, place and secure anchorage devices.
    a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    b. Cast anchor-bolt insert into bases.
    c. Install anchor bolts to elevations required for proper attachment to supported equipment.

3.9 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
        1) Recoat areas subject to heavy rainfall within three hours after initial application.
        2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
    a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
        1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
            a) Lap edges and ends of absorptive cover not less than 12 inches.

b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
   a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
   b) Cure for not less than seven days.

3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

c. Floors to Receive Polished Finish: Contractor has option of the following:

1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
   a) Lap edges and ends of absorptive cover not less than 12 inches.
   b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.

2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
   a) Water.
   b) Continuous water-fog spray.

d. Floors to Receive Chemical Stain:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
3) Butt sides of curing paper tight; do not overlap sides of curing paper.
4) Leave curing paper in place for duration of curing period, but not less than 28 days.

e. Floors to Receive Urethane Flooring:

1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

f. Floors to Receive Curing Compound:
1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
2) Recoat areas subjected to heavy rainfall within three hours after initial application.
3) Maintain continuity of coating, and repair damage during curing period.

3.10 TOLERANCES

A. Conform to ACI 117.

3.11 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s).
2. Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency to be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31/C31M.
2. Testing agency to immediately report to Architect, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
3. Testing agency to report results of tests and inspections, in writing, to Owner, Architect, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
a. Test reports to include reporting requirements of ASTM C31/C31M, ASTM C39/C39M, and ACI 301, including the following as applicable to each test and inspection:
1) Project name.
2) Name of testing agency.
3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
4) Name of concrete manufacturer.
5) Date and time of inspection, sampling, and field testing.
6) Date and time of concrete placement.
7) Location in Work of concrete represented by samples.
8) Date and time sample was obtained.
9) Truck and batch ticket numbers.

10) Design compressive strength at 28 days.
11) Concrete mixture designation, proportions, and materials.
12) Field test results.
13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
14) Type of fracture and compressive break strengths at seven days and 28 days.

B. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.

C. Inspections:
1. Headed bolts and studs.
2. Verification of use of required design mixture.
3. Concrete placement, including conveying and depositing.
4. Curing procedures and maintenance of curing temperature.
5. Verification of concrete strength before removal of shores and forms from beams and slabs.
6. Batch Plant Inspections: On a random basis, as determined by Architect.

D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172/C 172M to be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing to be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C143/C143M:
a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
b. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C231/C231M pressure method, for normal-weight concrete; ASTM C173/C173M volumetric method, for structural lightweight concrete.
a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M:
a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M:
a. Cast and laboratory cure two sets of two 6-inch by 12-inch or 4-inch by 8-inch cylinder specimens for each composite sample.
b. Cast, initial cure, and field cure two sets of two standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M.
a. Test one set of two laboratory-cured specimens at 7 days, one set at 14 days, and one set of two specimens at 28 days.
b. Test one set of two field-cured specimens at 7 days, one set at 14 days, and one set of two specimens at 28 days.
c. A compressive-strength test to be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.

7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor to evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi if specified compressive strength is 5000 psi, or no compressive strength test value is less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
10. Additional Tests:
    a. Testing and inspecting agency to make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
    b. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42/C42M or by other methods as directed by Architect.
        1) Acceptance criteria for concrete strength to be in accordance with ACI 301, Section 1.6.6.3.
11. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
12. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.13 PROTECTION

A. Protect concrete surfaces as follows:
    1. Protect from petroleum stains.
    2. Diaper hydraulic equipment used over concrete surfaces.
    3. Prohibit vehicles from interior concrete slabs.
    4. Prohibit use of pipe-cutting machinery over concrete surfaces.
    5. Prohibit placement of steel items on concrete surfaces.
    6. Prohibit use of acids or acidic detergents over concrete surfaces.

END OF SECTION 03 30 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Concrete masonry units.
   2. Mortar and grout.
   3. Steel reinforcing bars.
   4. Masonry-joint reinforcement.
   5. Embedded flashing.
   6. Miscellaneous masonry accessories.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 FIELD CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
   1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
   1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
   2. Protect sills, ledges, and projections from mortar droppings.
   3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
   4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
   1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
   2. Provide square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units .
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

C. CMUs: ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2150 psi .
   2. Density Classification: Normal weight .
   3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.
   4. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.

2.3 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
   1. Alkali content is not more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Cement: ASTM C1329/C1329M.

F. Aggregate for Mortar: ASTM C144.
   1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
   2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
   3. White-Mortar Aggregates: Natural white sand or crushed white stone.
   4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

G. Aggregate for Grout: ASTM C404.

H. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494/C494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

I. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent from same manufacturer.

J. Water: Potable.

2.4 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
   1. Exterior Walls: Hot-dip galvanized carbon steel.
   2. Wire Size for Side Rods: 0.148-inch diameter.
   3. Wire Size for Cross Rods: 0.148-inch diameter.
   4. Spacing of Cross Rods: Not more than 16 inches o.c.
   5. Provide in lengths of not less than 10 feet.

2.5 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or PVC.

B. Preformed Control-Joint Gaskets: Made from PVC, complying with ASTM D2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.

C. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D226/D226M, Type I (No. 15 asphalt felt).

2.6 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.
   1. Do not use calcium chloride in mortar or grout.
   2. Use masonry cement or mortar cement mortar unless otherwise indicated.
   3. For exterior masonry, use portland cement-lime masonry cement or mortar cement mortar.
   4. For reinforced masonry, use portland cement-lime masonry cement or mortar cement mortar.
   5. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
   1. For masonry below grade or in contact with earth, use Type S.
   2. For reinforced masonry, use Type S .
   3. For mortar parge coats, use Type S .
   4. For exterior, above-grade, load-bearing and nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type N.

C. Grout for Unit Masonry: Comply with ASTM C476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
   2. Proportion grout in accordance with ASTM C476, .
   3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
   2. Verify that foundations are within tolerances specified.
   3. Verify that reinforcing dowels are properly placed.
   4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
   5. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond ; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below, and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
1. Bed face shells in mortar and make head joints of depth equal to bed joints.
2. Bed webs in mortar in all courses of piers, columns, and pilasters.
3. Bed webs in mortar in grouted masonry, including starting course on footings.
4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

D. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

E. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 MASONRY-JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
1. Space reinforcement not more than 16 inches o.c.
2. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.
3. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings in addition to continuous reinforcement.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at corners, returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry using one of the following methods:
   1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout, and rake out joints in exposed faces for application of sealant.
   2. Install preformed control-joint gaskets designed to fit standard sash block.
   3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
   4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.8 LINTELS

A. Provide masonry lintels where shown and where openings of more than 24 inches for block-size units are shown without structural steel or other supporting lintels.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 FLASHING

A. General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   3. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
   4. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
   5. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.
   6. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal flashing termination.
   7. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

3.10 REINFORCED UNIT MASONRY

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches .

3.11 PARGING

A. Parge exterior faces of below-grade masonry walls, where indicated, in two uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat, and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.12 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
   1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
   2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.13 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 22 23 - ARCHITECTURAL CONCRETE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Architectural concrete masonry exterior single wythe walls.
   2. Weather seal and graffiti control repellent

B. Related Sections
   1. Section 04 22 00 – Concrete Unit Masonry for reinforcement and accessories

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Convene an architectural masonry conference approximately two weeks before scheduled commencement of masonry construction and associated work.
   2. Require attendance of installers of components that are to be built-into or otherwise concerned with masonry performance, and installers of other work in and around the masonry which must precede or follow the work and including the Architect, Owner, window, door and roofing representatives and the architectural masonry manufacturer's representative.
   3. Objectives include:
      a. Review foreseeable methods and procedures related to masonry work, including set up and mobilization areas for stored material and work area.
      b. Tour representative areas to receive masonry, inspect and discuss condition of substrate, penetrations and other preparatory work.
      c. Review work of other trades and make provisions to permit installation of their work in a manner to avoid cutting and patching.
      d. Review masonry requirements, Drawings, Specifications and other Contract Documents, including these topics:
         1) Review and critique the completed Sample panel(s).
         2) Demonstrate cleaning procedures on the sample panel.
         3) Set schedule for pre-cleaning meeting and cleaning after installation.
         4) Location of Movement (Control) Joints.
         5) Use of compatible water repellent admixtures for mortar.
         6) Availability of clean and potable water for project.
         7) Installation of flashing details.
         8) Open issues and concerns.
         9) Cold/Hot weather procedures.
         10) Protecting masonry during constructing, including covering walls.
         11) Post-applied products, prep and requirements.
      e. Review and finalize schedule related to masonry and related work and verify availability of materials, installer's personnel, equipment and facilities needed to make progress and avoid delays.
      f. Review required inspection, testing, certifying procedures.
      g. Review weather and forecasted weather conditions and procedures for coping with unfavorable conditions.
      h. Record conference including decisions and agreements reached. Furnish a copy of records to each party attending.

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods including written plan for cold and hot weather construction and masonry cleaning procedures.

B. Shop Drawings: Show details of constructions and components to be incorporated into Work including, but not limited to the following:
   1. Special Masonry Shapes
   2. Flashing: Details for each element of flashing system showing layout, profiles, and methods of joining; including lintel units, shelf units, corner units, end dam units, conditions showing interface and relationship to adjacent materials and other special applications.
   3. Reinfocing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of rinforced masonry assemblies.
   4. Control Joints: Show sizes and locations.

C. Selection Samples: Submit three full size units of each type/color of exposed architectural concrete masonry unit for review of color and texture to verify compliance with products specified. Provide the maximum color and texture variation range expected in the finished work.
   1. Clean and seal two units with graffiti control.

D. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturer's Certificates and Test Reports: Certify products meet or exceed specified requirements. Test reports should be within 12 months of bid date.

B. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in TMS 602/ACI 530.1/ASCE 6.

C. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109 for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

D. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

E. Source Quality-Control Submittals:
   1. Source quality-control reports.

F. Field Quality-Control Submittals:
   1. Field quality-control reports.

G. Qualification Statements: For manufacturer, Installer, and testing agency

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For cleaning of masonry product.

1.6 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturers: Company specializing in manufacturing products specified in this section with a minimum ten years documented experience and a current member in good standing of the National Concrete Masonry Association.
   2. Installer: Company specializing in performing Work of this section with minimum five years documented experience with projects of similar scope and complexity.
   3. Testing Agency: Qualified according to ASTM C 1093 for testing indicated.

B. Source Limitations: Provide each type of masonry unit from a single manufacturing source to ensure uniform texture and color for continuous and visually related items.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver architectural concrete masonry units to the job site on wood pallets with manufacturer's recommended unit protective covers.

B. Inspect architectural concrete masonry units upon delivery to ensure color match with required materials and accepted samples.

C. Stack masonry units in a dry place off the ground on pallets or a prepared plank platform. Method of stacking is acceptable. Protect with non-staining waterproof tarpaulin coverings arranged to allow air circulation around and above masonry units.

D. Exercise care in the storage, handling and installation of masonry units. Do not build soiled or damaged masonry units into the work.

1.8 SEQUENCING

A. Ensure that locating templates and other information required from others for built-in installation of products of this section are furnished in time to prevent interruption of construction progress.

1.9 FIELD CONDITIONS

A. Follow hot weather and cold weather requirements in the masonry code and specifications, TMS 402 and TMS 602.

B. Cold Weather Procedures:
   1. Preparation:
      a. If ice or snow has formed on the masonry bed, remove it by carefully applying heat not to exceed 120 degrees F until the surface is dry to the touch.
      b. Remove any brick units or mortar that is frozen or damaged.
      c. When the clay masonry unit suction exceeds 30 grams per minute per 30 square inches, sprinkle with heated water as follows:
      d. When units are 32 degrees F or above, heat water to 70 degrees F or above.
      e. When units are below 32 degrees F, heat water to 130 degrees F or above.
   2. Work in Progress:
      a. Air temperature 40 degrees F to 32 degrees F:

1) Heat sand or mixing water to produce mortar temperatures that match air temperature.

b. Air temperature 32 degrees F to 25 degrees F:

1) Heat sand and mixing water to produce mortar temperatures between 40 degrees F and 120 degrees F.

2) Maintain temperature of mortar on boards above freezing.

3) Installation in colder air temperatures will require heat sources on the wall and the use of windbreaks or tents to create a controlled environment suitable for proper bonding and curing.

3. Completed Work and Work Not in Progress:

a. Mean daily air temperature of 40 degrees F to 32 degrees F: Protect masonry from rain and snow for 24 hours by covering with a weather-resistive membrane.

b. Mean daily air temperature of 32 degrees F to 25 degrees F: Cover masonry with a weather-resistive membrane for 24 hours.

c. Mean daily air temperature of 25 degrees F to 20 degrees F: Cover masonry with insulating blankets for 24 hours.

C. Hot Weather Procedures:

1. When ambient temperature exceeds 90 degrees F and wind exceeds 8 miles per hour:

a. Maintain temperature of mortar and grout between 70 degrees F and 120 degrees F.

b. Limit the spread of the mortar bed to 4 feet and place units within 1 minute of spreading mortar.

c. Control moisture evaporation in partially or newly completed walls by fog spraying with potable water, covering with opaque plastic or canvas or both.

2. Protection of Work in Progress:

a. Covering:

1) Cover tops of walls with a strong waterproof membrane at the end of each day or work shutdown. Extend the waterproof membrane cover a minimum of 24 inches down the side of each wall.

2) Hold cover securely in place.

b. Load Application:

1) Do not apply uniform floor or roof loading for at least 12 hours after completing columns and walls.

2) Do not apply concentrated loads for at least 3 days after completing columns and walls.

c. Staining:

1) Prevent grout and mortar from staining the face of masonry.

2) Remove grout and mortar that comes in contact with masonry units immediately.

3) Protect sills, ledges and projections from mortar droppings.

4) Protect base of wall from rain-splashed mud and mortar splatter.

5) Turn scaffold boards on edge when work is not in progress to lessen splattering.

D. Coordination: Coordinate Work to ensure top of wall is covered and remains covered until properly block openings are protected with coping or finishing system indicated on the Drawings

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODUCTS

A. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having

equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 PERFORMANCE REQUIREMENTS

A. Concrete Unit Masonry Construction: Comply with the following:
   1. TMS 602-13 / ACI 530.1- 13 / ASCE 6-13 - Building Code Requirements for Masonry Structures.
   2. TMS 602-13 / ACI 530.1- 13 / ASCE 6-13 - Specification for Masonry Structures.
   3. National Concrete Masonry Association (NCMA) TEK Bulletins.

B. Provide structural unit masonry that develops indicated net-area compressive strengths at 28 days
   1. Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to Tables 1 and 2 in TMS 402/ ACI 530.1/ASCE 5 and TMS 602/ ACI 530.1/ ASCE 6
   2. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

C. Pre-installed two piece, interlocking, Concrete Masonry Unit Insulation.
   1. Description: Concrete Block Insulation Systems, Inc. expanded polystyrene Insulation Inserts made from flame-retardant treated expandable polystyrene which are pre-installed in CMU's prior to delivery to jobsite;
   2. Physical Properties of EPS:
      a. Typical Density (lbs/cu.ft.) Min.: 1.05-1.50
      b. Thermal Resistance (R) per inch: 5.00
      c. Water Vapor Permeance: 1.10
      d. Water Absorption% volume: <1.00
      e. Flame Spread Rating: <5.00
   3. Additional Properties of EPS Inserts:
      a. Rot and Vermin resistance: Produced from expanded polystyrene – full resistant to rot; does not attract vermin, termites or rodents.
      b. Components: Insulation shall contain no fluorocarbons and no formaldehyde.
      c. Shape: Two-piece, interlocking insert shall overlap at both head & bed joints with edges of adjacent inserts of the same type. Keyway shall be provided for butt welded cross-rods of 16" o.c. ladder type horizontal wall reinforcement.

2.3 MATERIALS

A. Aggregate:
   1. ASTM C 33 normal weight aggregate.
   2. ASTM C 331 lightweight aggregate.

B. Cement: ASTM C 150, Type required. Color, White/Grey as required for use with the color specified.

C. Water Repellent Admixture: Integral polymeric water repellent admixture for concrete masonry units used in masonry exposed to the exterior.
   1. Performance requirements:
      a. Water resistance: ASTM E 514

D. Color Pigments: Lightfast, alkali-resistant, weather-resistant natural or synthetic iron oxides manufactured specifically for use in concrete masonry units.

2.4 ARCHITECTURAL CONCRETE MASONRY UNITS

A. Hollow Load Bearing Units: Provide unit type and size(s) indicated on the drawings
   1. Masonry units meeting all ASTM C 90 testing requirements and containing integral mixed color:
      a. Basis of Design: Spec-Thermal Hi-R insulated Masonry Units.
         1) Type: As indicated on drawings
   2. Unit Weight:
      a. Normal weight units.
   3. Linear shrinkage: Not to exceed 0.065 percent, ASTM C 90.
   4. Unit Compressive Strength: Minimum net area compressive strength of 2,000 psi.
   5. Integral Water Repellent Concrete Masonry Units: Provide all exterior wall architectural concrete masonry units, including single wythe walls and facing units, containing the manufacturer's recommended type and amount of an integral polymeric water repellent admixture.
   6. Color: As indicated on Drawings

B. Pre-installed two-piece, interlocking Concrete Masonry Unit Insulating Inserts:
   1. Product: Korfil Hi-R inserts manufactured by Concrete Block Insulating Systems and distributed by members of the Concrete Products:
      a. Korfil Hi-R insert

C. Special shapes:
   1. Provide closures, jamb units, headers, lintels, bond beams and other special shapes as indicated.
   2. Provide standard manufactured sizes or cut full size units for fractional course height and lengths.

2.5 MASONRY ACCESSORIES

A. Mortar and grout: Comply with Sections 042200. Provide water repellent admixture for exterior wall mortar and grout.
   1. Water Repellent Mortar Admixture: Exterior wall mortar admixture shall be compatible to the admixture used to produce the masonry units. Coordinate the selection with the masonry unit manufacturer.
   2. Comply with manufacturer's instructions for mixing and mortar preparation.
   3. When using bulk pre-blended mortar (silos,bulk bags, etc.) with dry admixture, the admixture in the pre-blended mortar MUST be from the same producer or compatible with that used in the CMU materials.

B. Pan Flashing: BlockFlash, by MortarNet in single wythe walls.

C. Control Joints:
   1. Vinyl: ASTM D 2287.

D. Weeps: Weeps are to be used in conjunction with flashing materials for proper functioning of the masonry wall drainage system. Specified weep material is:
   1. BlockFlash, by MortarNet in single wythe walls

E. Masonry Cleaning Materials: Standard-strength proprietary masonry cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new concrete masonry without discoloring or damaging masonry surfaces. Provide cleaning product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units.

F. Masonry Sealing and graffiti control Materials: Provide cleaning material manufacturer's compatible masonry sealer coating for all single wythe concrete masonry exterior walls.
   1. Basis of Design: Prosoco Sure Klean Weather Seal Blok-Guar & Graffiti Control II.

2.6 SOURCE QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to evaluate masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, structure and installation conditions. Do not proceed with architectural concrete masonry work until unsatisfactory conditions have been corrected.

B. Verify items provided by other Sections of work are properly sized and located.

C. Verify that items to be built in are in proper location, and ready for roughing into masonry work.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean substrate surfaces thoroughly prior to installation.

B. Establish lines, levels and coursing. Verify anchors and flashings are correctly located and installed.

C. Furnish temporary bracing as required during installation of masonry work. Maintain in place until building structure provides permanent support.

D. Do not wet concrete masonry units except as per TMS 402/602

E. Prepare surfaces using the methods recommended by the manufacturer for achieving the

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Layout walls in advance for accurate spacing of surface bond patterns, with uniform joint widths and to properly locate openings, movement type joints, returns and offsets. Whenever possible, avoid the use of less than half-size units at corners, jambs and other locations. Notify Design Professional when split masonry coursing at heads and sills of openings and cut concrete masonry coursing less than 4 inches in height not permitted.

C. Lay up walls plumb and true to comply with specified tolerances. Provide square corners, except as otherwise indicated, with courses level, accurately spaced and coordinated with other work. Use double lines at multiple wythe walls.

D. Pattern bond: Lay exposed concrete unit masonry in running bond with vertical joint in each course centered on units in courses above and below. Bond and interlock each course of each wythe at corners. Do not use units with less than 4 inches of horizontal face dimensions at corners or jambs. Install special shape units where indicated.

E. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course on footings, load bearing walls, all courses of piers, columns and pilasters and where adjacent to cells or cavities to be reinforced or filled with concrete or grout. Maintain 3/8 inch nominal joint widths, except as necessary at first course bed joints, and except for minor variations required to maintain bond alignment

F. Lay solid concrete masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not slush head joints

G. Compress and cut joints flush for masonry walls that are below grade, concealed or covered by other materials.

H. Tool joints in all exposed masonry work to a concave joint when thumb print hard, unless plans indicate otherwise.

I. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

J. Step back unfinished work adjoining new work. Rack back 1/2 unit length in each course; do not tooth. Clean exposed surfaces of set masonry and remove loose masonry units and mortar before laying fresh masonry.

K. Provide interlocking masonry bond in each course at corners and intersecting walls, unless otherwise indicated on plans such as for stack bond.

L. Load-bearing walls: If carried up separately, provide rigid steel anchors spaced not more than 2 feet on center vertically. Embed ends in mortar filled cores. Build full height of story to underside of structure. Grout juncture with structure solid with grout.

M. Pre-installed two-piece, interlocking Concrete Masonry Unit Insulating Inserts:
   1. General: Inserts shall be pre-installed by CMU manufacturer prior to delivery to jobsite.
   2. Unless otherwise indicated on Construction Documents, inserts shall be left in place when grouting.

N. As the work progresses, build in items specified under this and other Sections of the specifications. Fill in solidly with masonry around built-in items.
   1. Bed hollow metal frame anchors in mortar. Align anchors with joint coursing. Draw anchors tight and fill space between hollow metal frames and masonry solid with fine mortar grout.
   2. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath or other approved material, in the joint below and rod grout into core.
   3. Provide solid masonry bearing for all lintels, beams, joists, plates and load-bearing members.
   4. Provide hollow units filled solid:
      a. Minimum one block course under steel angle lintels and steel joists not bearing on bond beams.
      b. Minimum two block courses under steel beams and steel beam lintels. Where beams and lintels are parallel with wall, extend solid bearing to walls, extend solid bearing 16 inches each side of centerline of beam.
   5. Take particular care to embed all conduits and pipes within concrete masonry without fracturing exposed shells and to fit units around switch, receptacle and other boxes set in walls. Where electric conduit, outlets, switch boxes and similar items occur, grind and cut units before building in services.
   6. Install anchors and reglets for flashing and related work built into masonry work.

7. Install reinforcing steel and grout where indicated. Comply with Drawing details for reinforcing steel size and spacing.

O. Single Wythe walls::
   1. Lay masonry units with full head and bead joints.
   2. Tool both interior and exterior mortar joints
   3. Install all units with "Water Control Technology" (WCT) in proper, "up" position.

P. Horizontal joint reinforcing: Install continuous joint reinforcing at all single wythe and back-up concrete masonry walls as follows:
   1. In every second block course, 16 inches on center vertically, full height of wall and every block course where shown on the Drawings.
   2. In the first two bed joints immediately above and below all openings so that it extends a minimum of 24 inches beyond opening each way.
   3. In the bed joints of the first and second courses below the bearing line in bearing walls when wall receives uniformly distributed floor or roof loads in bed joints 16 inches below bond beams.
   4. Lap reinforcement a minimum of 6 inches and full width at corners and intersections or use special fabricated sections.
   5. Cut or interrupt joint reinforcement at vertical movement control or expansion joints, unless otherwise indicated.
   6. Prefabricated metal joint reinforcement shall not be used as wall ties in multiple wythe walls, except for composite wall construction and two adjacent tiers of concrete block.
   7. Fully embed side rods in mortar

Q. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:
   1. Provide an open space not less than 1/2 inch width between masonry and structural member. Keep open space free of mortar or other rigid materials.
   2. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to the structure. Provide anchors with adjustable tie sections. Space anchors not more than 24 inches on center vertically and 36 inches on center horizontally.
   3. Anchor veneers to concrete structural members with dovetail anchors.

R. Control Joints: Provide control joints for exterior masonry construction.
   1. Provide sash blocks with premolded shear key. Rake out mortar, if any, and form continuous vertical joints in masonry construction to receive joint sealant at the locations listed below.
   2. Locate control joints as indicated on the Drawings.

S. Bond Beams: Install bond beams where indicated. Comply with Drawings for reinforcing steel size and spacing. Fill bond beam masonry units solid with concrete fill or coarse mortar grout. Use smooth dowels to allow for horizontal movement at control joints unless otherwise indicated on the Drawings.

T. Lintels:
   1. Provide minimum bearing at each jamb of 4 inches for openings for less than 6 feet.

U. Flashing and weeps: Install flashing as specified in Section 07 62 00 - Sheet Metal Flashing and Trim.
   1. Install weeps in head joints of final course of exterior masonry wythe above flashing. Space weeps maximum of 24 inches on center horizontally with exterior ends and located to avoid door openings. Install weeps at head joints with outside face of weep material held 1/8 inch from the finish face of masonry unit.

2. Install cavity fill on top of base flashing. Install a bed of mortar, conforming to the curve of the flashing, placed under the metal flashing.
3. Install vents in head joints of final top course exterior masonry veneer wythe. Install at head joints with outside face of vent material held 1/8 inch from the finish face of masonry unit. Space vents 24 inches on center horizontally.
4. Install compressible joint material at lintels and horizontal steel members. Build in joint fillers and seal with joint sealant specified in Section 07 90 00 - Joint Protection.

3.4 REINFORCED CONCRETE MASONRY

A. Fill scheduled wall and column masonry work. Fill all cores solid with concrete fill/coarse masonry grout as specified in Section 04 05 16.26 - Engineered Masonry Grouting.

B. Grouting: Comply with TMS 602 grout placement requirements. Consolidate grout at time of placement.

C. Low-Lift Grouting: Place concrete fill/coarse masonry grout in maximum 5 foot vertical lifts.

D. High-Lift Grouting (If Approved): Place concrete fill/coarse masonry grout in maximum 12 foot vertical lifts (Recommend the use of super plasticizer with hi-lift grout).

E. Recess top of grout fill minimum 1-1/2 inches below top of course to form a key with following lift.

F. Where vertical reinforcing is required, install reinforcing before filling operation. Wet sticking of reinforcing is not permitted. Comply with Drawing details for reinforcing steel size and spacing.

G. Install bond beams where indicated. Install reinforcing before filling operation. Fill units solid with grout. Comply with drawing details for reinforcing steel size and spacing.

3.5 REPAIR AND POINTING

A. Clean and point exposed architectural concrete masonry at end of each working day. Remove and re- place masonry units that are loose, chipped, broken, stained, or otherwise damaged. Provide new units to match adjoining units and install in fresh mortar pointed to eliminate evidence of replacement.

B. During the tooling of joints, enlarge any voids or holes, except weeps and completely fill with mortar. Point up all joints at corners, openings and adjacent work to provide a neat, uniform appearance. Remove line pins and fill all line pin holes.

C. Wipe off excess mortar as the work progresses. Dry brush with bristle brushes exposed masonry at the end of each day's work. Remove mortar spatters and joint ridges.

3.6 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections: Level 1 special inspections according to the "International Building Code."
1. Begin masonry construction only after inspectors have verified proportions of site- prepared mortar.

2. Place grout only after, inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

F. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

G. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.7 CLEANING

A. Cut out defective mortar joints and holes in exposed masonry and re-point with mortar of matching color and texture. Commence cleaning of the masonry walls as soon as the mortar is thoroughly set and cured. After mortar has cured for a period of 7 days (and no later than 14 days after completion of installation), the cleaning process can begin.

B. Demonstrate the cleaning procedure on the sample panel at the job site prior to commencing cleaning on the building. When the sample panel is cleaned to the approval of the Architect, and the walls are complete, clean the building with the approved cleaning method.

C. Protect adjacent and surrounding surfaces not intended to be cleaned from exposure to the cleaning chemical to prevent damage.

D. Prevent cleaning chemical from coming into contact with people, motor vehicles, landscaping and other building materials that could be harmed by such contact. Follow Masonry cleaner Manufacturers' recommendations for personal protection.

E. Clean the exposed masonry surfaces of stains, efflorescence, mortar, grout dropping and debris using methods that do not damage the masonry. Do not use high pressure cleaning or aggressive scrubbing after cleaner application.

F. The results of the cleaning process shall be inspected by the project Architect or authorized owner representative for acceptance after the walls have dried. For cleaning results to be accepted, the walls must comply with the standard set for the cleaning results on the sample panel, and the walls shall be free from mortar or efflorescence stains, and the color and texture of the finished walls shall not show damage, discoloration or staining from the cleaning process. If such damage or stains are present, then the walls must be cleaned and color corrected, as needed, to remove any such stains, discoloration or damage prior to the application of Coatings

G. After cleaning allow units to dry and when specified apply a sealer as provided in Section 3.8.

3.8 COATING

A. After the results of the cleaning process have been fully accepted by the Architect, apply a colorless, non-staining, non-yellowing, breathable, penetrating water repellent. It shall be applied to the exterior exposed surface of the concrete masonry walls. Water-repellents must be capable of performing over hairline cracks and small voids less than 1/16". "Film Forming" Acrylic sealers will not be allowed. The water-repellent must not alter the color or texture of the wall after the material has fully cured. Follow manufacturer's application recommendations.

3.9 PROTECTION

A. Protect installed products until completion of project.

B. Protect top of wall until covered or capped to a waterproof condition by subsequent construction.

C. Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Remove immediately any grout, mortar, and soil that comes in contact with such masonry

D. Protect base of walls from rain-splashed mud and mortar splatter by means of coverings spread on ground and over wall surface.

E. Protect sills, ledges, and projection from mortar splatter and dropping.

F. Protect surfaces of windows and door frames; as well as similar products with painted and integral finishes from mortar splatter and dropping

G. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 04 22 23

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Framing with dimension lumber.
   2. Rooftop equipment bases and support curbs.
   3. Wood blocking and nailers.
   4. Wood furring.
   5. Wood sleepers.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. Lumber grading agencies, and abbreviations used to reference them, include the following:
   1. NeLMA: Northeastern Lumber Manufacturers' Association.
   2. NLGA: National Lumber Grades Authority.
   3. SPIB: The Southern Pine Inspection Bureau.
   4. WCLIB: West Coast Lumber Inspection Bureau.
   5. WWPA: Western Wood Products Association.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
   1. Factory mark each piece of lumber with grade stamp of grading agency.
   2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
   3. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:
   1. Boards: 15 percent.
   2. Dimension Lumber: 15 percent unless otherwise indicated.

2.2 DIMENSION LUMBER FRAMING

A. Joists, Rafters, and Other Framing by Grade: No. 2 grade.
   1. Species:
      a. Spruce-pine-fir; NLGA.

2.3 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Rooftop equipment bases and support curbs.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of the following species:
   1. Spruce-pine-fir; NLGA.

C. Concealed Boards: 15 percent maximum moisture content and the following species and grades:
   1. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 FASTENERS

A. General: Fasteners are to be of size and type indicated and comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.
   1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 .
   2. For pressure-preservative-treated wood, use stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F1667.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, and similar supports to comply with requirements for attaching other construction.

C. Do not splice structural members between supports unless otherwise indicated.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
   1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

E. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use inorganic boron for items that are continuously protected from liquid water.
   2. Use copper naphthenate for items not continuously protected from liquid water.

G. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

H. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
   3. ICC-ES evaluation report for fastener.

I. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

J. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for screeding or attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 INSTALLATION OF RAFTER FRAMING

A. Rafters: Notch to fit exterior wall plates and toe nail or use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal

hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

B. Provide collar beams (ties) as indicated or, if not indicated, provide 1-by-6-inch nominal- size boards between every third pair of rafters, but not more than 48 inches o.c. Locate below ridge member, at third point of rafter span. Cut ends to fit roof slope and nail to rafters.

C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

3.4 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof sheathing.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Emissions: Products are to meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

B. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

C. Factory mark panels to indicate compliance with applicable standard.

2.2 ROOF SHEATHING

A. Plywood Sheathing, Roofs: DOC PS 1 , Exterior sheathing.
   1. Span Rating: Not less than 24/0 .
   2. Nominal Thickness: Not less than 15/32 inch .

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
   1. For roof sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M .

B. Nails, Brads, and Staples: ASTM F1667.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:
   1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
   2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in the ICC's International Residential Code for One- and Two-Family Dwellings.
   3. ICC-ES evaluation report for fastener.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF WOOD STRUCTURAL SHEATHING

A. Fastening Methods: Fasten panels as indicated below:
   1. Roof Sheathing:
      a. Nail to wood framing.
      b. Space panels 1/8 inch apart at edges and ends.

END OF SECTION 06 16 00

SECTION 07 21 00 - THERMAL INSULATION

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. Extruded polystyrene foam-plastic board insulation.
   2. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Extruded polystyrene foam-plastic board insulation.
   2. Glass-fiber blanket insulation.
   3. Spray-applied cellulosic insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Chemical Company (The).
      b. DuPont de Nemours, Inc.
      c. Owens Corning.
   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.

4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Kraft Faced : ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Certainteed; SAINT-GOBAIN.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
   2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

C. Exterior Insulation Joint Treatment: Manufacturer's standard flashing and sealant products used to maintain air barrier continuity of insulation system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
   1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
   2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
   3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
   4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. 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.

1.2 ACTION SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.

1.3 INFORMATIONAL SUBMITTALS

A. Product test reports.
   1. Certificates: Furnish manufacturer's certification that spray-applied thermal insulation is free of asbestos (including actinolite, amosite, anthophyllite, chrysoltile, crocidolite and tremolite), or other toxic materials.
   2. Compatibility and Adhesion Test Reports: From manufacturer indicating the following:
      a. Materials have been tested for bond with substrates.
      b. Materials have been verified by spray-applied thermal insulation manufacturer to be compatible with substrate primers and coatings.
      c. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

B. Qualification Data: For spray-applied insulation installer.
   1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with a minimum of ten years experience manufacturing products in this section shall provide all products listed.

B. Spray-Applied Thermal Insulation Installer Qualifications:
   1. Experience: Installer with not less than 5 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years, and with sufficient production capability, facilities, and personnel to produce required Work.
   2. Supervision: Installer shall maintain a competent supervisor who is at Project during times specified Work is in progress, and, who is experienced in installing systems similar to type and scope required for Project.
   3. Manufacturer Acceptance: Installer shall be certified, approved, licensed or acceptable to manufacturer to install products.

1.5 PERFORMANCE REQUIREMENTS

A. 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.

1.6 PRE-INSTALLATION CONFERENCE

A. Pre-Installation Conference: Before Work begins, conduct conference at Project site to comply with requirements of applicable Division 01 Sections.

B. Minimum Agenda: Installer shall demonstrate understanding of the Work required by describing detailed procedures for preparing, installing, and cleaning the Work. Demonstration shall include, but not be limited to, following topics:

1. Tour representative areas of Work, inspect and discuss condition of substrate, and other preparatory work performed by other trades.
2. Review Work requirements (Drawings, Specifications, and other Contract Documents).
3. Review required submittals, both completed and yet to be completed.
4. Review and finalize construction schedule related to Work and verify availability of materials, installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review required inspection, testing, certifying, and material usage accounting procedures.
6. Review environmental conditions and procedures for coping with unfavorable conditions.
7. Resolve deviations or differences between Contract Documents and the manufacturer’s specifications.

1.7 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.

1.8 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

PART 2 - PRODUCTS

2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM

A. Closed-Cell Spray Polyurethane Foam: ASTM C 1029, Type II, minimum density of 1.5 lb./cu. ft. and minimum aged R-value at 1-inch thickness of 6.2°F x h x sq. ft./Btu at 75°F.

1. 1.Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BASF Corporation; SPF.
b. CertainTeed Corporation.
c. Dow Chemical Company (The);
d. Henry Company.
e. Johns Manville; a Berkshire Hathaway company.
f. SWD Urethane Company.

2. Surface-Burning Characteristics: Comply with ASTM E 84; 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.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for Sections in which substrates and related work are specified and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation.

B. During wall construction, install embedded flashings including all through-wall flashings where indicated. Install flashing over vertical and horizontal legs of steel shelf angles and over transitions between vertical leg and CMU substrate.

3.3 INSTALLATION

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Application of the insulation shall be by a certified installer, and in compliance with he manfuacturer’s most current requirements and recommendations. Prior to construction, coordinate requirements for access and needed headroom at the area to be insulated.

C. Spray insulation to envelop entire area to be insulated and fill voids. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.

E. Scrape spray insulation overspray from metal framing and other substrates that receive applied materials.

F. Cover adjacent work subject to damage from fallout or overspray of insulation materials during application. Provide temporary enclosure as required to confine spraying operations and ensure adequate ambient conditions for temperature and ventilation.

G. Apply insulation material in thicknesses and densities not less than those required to achieve minimum R-value indicated.

END OF SECTION 07 21 19

SECTION 07 41 13.16 - STANDING-SEAM METAL ROOF PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes factory formed metal roof panels: Standing-seam, hidden fastener, non-insulated.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
   1. Meet with Owner, Architect, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of roof accessories and roof-mounted equipment.
   2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
   4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
   5. Review structural loading limitations of deck during and after roofing.
   6. Review flashings, special details, drainage, penetrations, equipment curbs, and condition of other construction that affect metal panels.
   7. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
   8. Review temporary protection requirements for metal panel systems during and after installation.
   9. Review procedures for repair of metal panels damaged after installation.
   10. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings:
   1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details. All fastening patterns shall be clearly designated to meet the specified wind speed requirements.
   2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.
   3. Indicate work to be field fabricated or field assembled.

C. Samples: For each type of metal panel indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Product test reports.

B. Warranties: Sample of special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance data.

B. Manufacturer's Warranty: Executed copy of manufacturer's warranty.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Installer of sheet metal roofing for a minimum of 10 years.

B. Roll-Formed Sheet Metal Roofing Fabricator Qualifications: Minimum of 10 years factory forming experience.

C. Sheet Metal Roofing Standard: Comply with SMACNA's "Architectural Sheet Metal Manual" and NRCA Waterproofing Manual and manufacturer’s installation guidelines.

D. Source Limitations: Obtain all components for roofing system from or approved by roofing system manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels on Project site as recommended by manufacturer to minimize damage, ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels and trims during installation for removal immediately after installation.

1.8 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.9 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

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.

1.10 WARRANTY

A. Product Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including rupturing, cracking, or puncturing.
      b. Deterioration of metals and other materials beyond normal weathering.
   2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace sheet metal roofing that shows evidence of deterioration of factory-applied finishes within specified warranty period.
   1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
   2. Finish Warranty Period: 30 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include:
   1. Architectural Metal Systems.
   2. ATAS International
   3. CENTRIA Architectural Systems.
   4. Morin - A Kingspan Group Company.
   5. Ultra Seam Incorporated.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 SOURCE LIMITATIONS

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592. Provide clips, fasteners, and clip spacing of type indicated and with capability to sustain, without failure, a load equal to 2 times the design negative uplift pressure.
   1. Wind Loads: As indicated on Drawings.

B. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

2.4 STANDING-SEAM METAL ROOF PANELS

A. General: Provide factory-formed metal roof panels designed to be installed by lapping and interconnecting raised side edges of adjacent panels with joint type indicated and mechanically attaching panels to supports using concealed clips in side laps. Include clips, cleats, pressure plates, and accessories required for weathertight installation.
   1. Steel Panel Systems: Unless more stringent requirements are indicated, comply with ASTM E1514.

B. Vertical-Rib, Snap-Joint, Standing-Seam Metal Roof Panels: Formed with vertical ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels, engaging opposite edge of adjacent panels, and snapping panels together.
   1. Basis-of-Design Product: ATAS International, Inc.: Dutch Seam MRD
   2. Metallic-Coated Steel Sheet: Zinc-coated (galvanized) steel sheet complying with ASTM A653/A653M, G90 (Z275) coating designation, or aluminum-zinc alloy-coated steel sheet complying with ASTM A792/A792M, Class AZ50 (Class AZM150) coating designation; structural quality. Prepainted by the coil-coating process to comply with ASTM A755/A755M.
   3. Nominal Thickness: 0.023 inch (0.56 mm)min..
   4. Exterior Finish: Two-coat fluoropolymer .
   5. Color: As indicated on drawings

C. Back Coating: Manufacturer's standard factory-applied, flexible, protective back coating.

D. Dutch Seam MRD:
   1. Seam Height: 1.5 inches (38 mm).
   2. Panel Width: 15 inches (381 mm) ; .

2.5 UNDERLAYMENT MATERIALS

A. Self-Adhering, High-Temperature Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 45 mils thick, consisting of slip-resistant, polyethylene-film top surface laminated to a layer of butyl or SBS-modified asphalt adhesive, with release-paper backing. Provide primer when recommended by underlayment manufacturer.
   1. Thermal Stability: Stable after testing at 240 deg F; ASTM D 1970.
   2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F; ASTM D 1970.
   3. Manufacturers: Subject to compliance with requirements, provide products by one of the following
      a. ATAS International, Inc
      b. Henry Company.
      c. Owens Corning.

B. Slip Sheet: Manufacturer's recommended slip sheet, of type required for application.

2.6 MISCELLANEOUS MATERIALS

A. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and ridges, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch-thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

B. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, eaves, rakes, corners, bases, framed openings, ridges, fasciae, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

C. Panel Fasteners: Self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads. Manufacturer shall provide or authorize all fasteners utilized with the sheet metal roofing system.
1. Exposed Fasteners: Heads matching color of sheet metal roofing by means of factory-applied coating.
2. Fasteners for Flashing and Trim: Blind fasteners or screws spaced to resist wind uplift loads.

D. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.
1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing; 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C 920; as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

E. Gutters: Formed from aluminum, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 144-inch (3658-mm) long sections, of size and metal thickness in accordance with SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match metal roof panels.

F. Downspouts: Formed from aluminum of the same color and finish as roof panels. Fabricate in 144-inch (3658-mm) long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match gutters.

2.7 FABRICATION

A. Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Sheet Metal Flashing and Trim: Factory-fabricate flashing and trim to comply with manufacturer's written instructions and ANSI/MCA FTS-1-2019, "Test Method for Wind Load Resistance of Flashings Used with Metal Roof Systems" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
3. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

D. No exposed cut edges on seams or panels.

2.8 FINISHES

A. Panels and Accessories:
1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat.

B. All areas of panel and trim accessories exposed to view to be finished.
1. Concealed Finish: White or light-colored acrylic or polyester backer finish.

C. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 UNDERLAYMENT INSTALLATION

A. Self-Adhering Sheet Underlayment: Apply primer if required by manufacturer. Comply with temperature restrictions of underlayment manufacturer for installation. Apply at locations indicated on Drawings, wrinkle free, in shingle fashion to shed water, and with end laps of not less than 6 inches staggered 24 inches between courses. Overlap side edges not less than 3-1/2 inches. Roll laps with roller. Cover underlayment within 14 days.
1. Apply over the entire roof surface.

B. Slip Sheet: Apply slip sheet over underlayment before installing metal roof panels.

3.2 METAL PANEL INSTALLATION

A. Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.

4. Remove protective film from surface of roof panels and trims immediately prior to installation.
5. Locate and space fastenings in uniform vertical and horizontal alignment.
6. Install flashing and trim as metal panel work proceeds.
7. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
8. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
9. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Standing-Seam Metal Roof Panel Installation: Fasten metal roof panels to supports with concealed clips at each standing-seam joint at location, spacing, and with fasteners recommended in writing by manufacturer.
1. Install clips to supports with self-tapping fasteners.
2. Install pressure plates at locations indicated in manufacturer's written installation instructions.
3. Snap Joint: Nest standing seams and fasten together by interlocking and completely engaging factory-applied sealant.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that will be permanently watertight and weather resistant.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

G. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.
1. Provide elbows at base of downspouts to direct water away from building.
2. Connect downspouts to underground drainage system indicated.

H. Pipe Flashing: Form flashing around pipe penetration and metal roof panels. Fasten and seal to metal roof panels as recommended by manufacturer.

3.3 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect metal roof panel installation, including accessories. Report results in writing.

B. Remove and replace applications of metal roof panels where tests and inspections indicate that they do not comply with specified requirements.

C. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

D. Prepare test and inspection reports.

3.4 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

END OF SECTION 07 41 13.16

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Roof hatches.
   2. Preformed flashing sleeves.
   3. Metal Materials
   4. Miscellaneous Materials

1.2 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.
   1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Delegated-Design Submittal: For [**roof curbs**] indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
   1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
   2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 WARRANTY

A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Finish Warranty Period: 20 years from date of Substantial Completion.

B. Manufacturer's standard warranty for Roof Hatch: Manufacturer warrants hatches in which manufacturer agrees to be free from manufacturing defects or replace roof hatch that shows evidence of failure of hardware and in materials, factory finishes, and workmanship. Manufacturer shall furnish a replacement or new part.
   1. Warranty Period: 5 years from the date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

2.2 ROOF HATCHES

A. Roof Hatches: Metal roof-hatch units with lids and insulated single -walled curbs, welded or mechanically fastened and sealed corner joints, continuous lid-to-curb counterflashing and weathertight perimeter gasketing, and integrally formed deck-mounting flange at perimeter bottom.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. Architectural Specialties, Inc.
      b. The Bilco Company
      c. Custom Solution Roof and Metal Products.
      d. Nystrom.
      e. O'Keeffe's Inc.

B. Type and Size: Single-leaf lid, 48 by 48 inches. .

C. Loads: Minimum 40-lbf/sq. ft. external live load and 20-lbf/sq. ft. internal uplift load.

D. Hatch Material: Zinc-coated (galvanized) steel sheet.
   1. Thickness: 14 gauge .
   2. Finish: Baked enamel or powder coat .
   3. Color: As selected by Architect from manufacturer's full range .

E. Construction:
   1. Insulation: 2-inch- thick, polyisocyanurate board.
   2. Nailer: Factory-installed wood nailer continuous around hatch perimeter.
   3. Hatch Lid: Opaque, insulated, and double walled, with manufacturer's standard metal liner of same material and finish as outer metal lid.
   4. Curb Liner: Manufacturer's standard, of same material and finish as metal curb.
   5. Fabricate curbs to minimum height of 12 inches above roofing surface unless otherwise indicated.
   6. Sloping Roofs: Where slope or roof deck exceeds 1:48, fabricate curb with perimeter curb height that is constant . Equip hatch with water diverter or cricket on side that obstructs water flow.

F. Hardware: Spring operators, hold-open arm, galvanized steel spring latch with turn handles, stainless steel butt- or pintle-type hinge system, and padlock hasps inside and outside.
   1. Spring: Gas spring with damper for smooth, controlled counterbalanced lift assistance.
   2. Gasket: Extruded EPDM Adhesive backed gasket seal, continuous around cover

2.3 PREFORMED FLASHING SLEEVES

A. Exhaust Vent Flashing: Double-walled metal flashing sleeve or boot, insulation filled, with integral deck flange, 12 inches high, with removable metal hood and metal collar.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Custom Solution Roof and Metal Products.
      b. Menzies Metal Products.
      c. Thaler Metal Industries Ltd.
   2. Metal: Aluminum sheet, 0.080 inch thick.
   3. Diameter: As indicated on Drawings .
   4. Finish: Match Architect's Sample .

2.4 METAL MATERIALS

A. Zinc-Coated (Galvanized) Steel Sheet: ASTM A653/A653M, G90 coating designation.
   1. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
   2. Exposed Coil-Coated Finish: Prepainted by the coil-coating process to comply with ASTM A755/A755M. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
      a. Two-Coat Fluoropolymer Finish: AAMA 621. System consisting of primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight.
   3. Baked-Enamel or Powder-Coat Finish: After cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat to a minimum dry film thickness of 2 mils.
   4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.

B. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.

C. Steel Tube: ASTM A500/A500M, round tube.

D. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.

E. Steel Pipe: ASTM A53/A53M, galvanized.

2.5 MISCELLANEOUS MATERIALS

A. 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.

C. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

D. Underlayment:

1. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS-modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.

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 A153/A153M or ASTM F2329.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

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 C920, 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 C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

I. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.6 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install roof accessories according to manufacturer's written instructions.
1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.

3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates 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 roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

C. Roof-Hatch Installation:
1. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.

D. Preformed Flashing-Sleeve Installation: Secure flashing sleeve to roof panel(s) according to flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof panel(s) according to roof membrane manufacturer's instructions.

E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 099100 "Painting."

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 08 17 43 - FRP / ALUMINUM HYBRID DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. FRP Doors with FRP frames.

B. Related Sections:
   1. Section 08 71 00 "Door Hardware" for coordination of hardware installed in door

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Manufacturer’s product data sheets, catalog pages illustrating the products, description of materials, components, fabrication, finishes, installation instructions, and applicable test reports.

B. Shop Drawings:
   1. Submit manufacturer’s shop drawings, including elevations, sections, and details indicating dimensions, tolerances, materials, fabrication, doors, panels, framing, hardware schedule, and finish.
   2. Shop drawings to indicate attachment and anchor requirements to other work for coordination.

C. Samples for Verification: Actual sample of finished products for each type of exposed finish.
   1. Size: 6 inch x 6 inch min.

1.3 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:
   1. Submit testing reports and evaluations provided by manufacturer conducted by and accredited independent testing agency certifying doors and frames comply with specified performance requirements

B. Qualification Statements: For manufacturer.

C. Sample warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:
   1. Submit manufacturer’s maintenance and cleaning instructions for doors and frames, including maintenance and operating instructions for hardware.

B. Warranty Documentation:
   1. Manufacturers' special warranties fully executed.

1.5 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturers:

a. Continuously engaged in manufacturing of doors of similar type to that specified, with a minimum of 20 years concurrent successful experience.
b. Door and frame components must be fabricated by same manufacturer.

1.6 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.
1. Store materials in a clean, dry area, indoors in accordance with manufacturer's instructions.

C. Handling.
1. Protect materials and finish from damage during handling and installation.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door and frames that fail(s) in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Excessive deflection
b. Faulty operation
c. Defects in hardware installation
d. Deterioration of finish or construction in excess of normal weathering.
1) Warranty Period: Ten year(s) from date of Substantial Completion.
2. Failures of corner joinery, core deterioration, and delaminating or bubbling of door skin.
a. Warranty Period: Limited Lifetime.
3. Finish
a. Kynar painted or anodized aluminum:
1) Warranty Period: 10 year(s) from date of Substantial Completion.
b. Painted face sheets of doors
1) Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include:
1. Cline Doors
2. Corrim Company
3. FRP Architectural Doors, Inc.
4. Metropolitan Door Industries (MDI)
5. Special-lite, Inc.

B. Basis of Design (Product Standard): Contract Documents are based on products and systems specified to establish a standard of quality. Other manufacturers offering products having equivalent characteristics may be considered, provided deviations are minor and comply with requirements of Contract Documents as judged by the Architect.

2.2 PERFORMANCE REQUIREMENTS

A. Thermal Transmittance, NFRC 100.
   1. U-Factor = 0.500 Btu/hr·ft²·°F.

2.3 FRP DOOR AND ALUMINUM FRAME

A. Door
   1. Basis of Design: Special-Lite: AF-220.
   2. Construction.
      a. Door Thickness: 1-3/4”.
   3. Stiles & Rails.
      a. Pultruded fiberglass with integral channels for securing corner reinforcing clip.
   4. Corners.
      a. Mitered.
      b. Secured with pultruded fiberglass corner clip chemically welded to stiles and rails.
      c. Mechanical fasteners to secure corner joints not acceptable.
   5. Core.
      a. Expanded Polystyrene.
         1) 2.0 pcf
         2) Mildew and rot resistant.
         3) Sound and vibration dampening.
   6. Face Sheet.
      a. Exterior
         1) 0.120” thick, Sandstone texture, through color FRP sheet.
         2) Class C standard.
      b. Interior
         1) 0.120” thick, Sandstone texture, through color FRP sheet.
         2) Class C standard.
      c. Attachment of face sheet.
         1) Face sheets to be flame treated.
         2) Face sheets adhered to stiles, rails, and core using hot melt adhesive evenly coated across all surfaces to produce strong bond and prevent moisture absorption
   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.
   8. Reinforcements.
      a. Solid high-density polyurethane shapes chemically welded to stiles, rails and/ or core.

B. Framing
   1. Description: FRP framing with integral stops
   2. Size: As indicated on drawings.
   3. Perimeter Frame Members.
      a. 3/16” thick pultruded fiberglass open throat with return.
      b. Factory fabricated.
   4. Integral Door Stops.
      a. 5/8” x 2-1/4”.
   5. Frame Assembly
      a. Standard knock down.
   6. Frame Member to Member Connections.
      a. Corners mitered with 2” x 2” x 1/4” pultruded FRP angle reinforcement with interlocking pultruded FRP brackets.

b. Provide hairline butt joint appearance.

7. Hardware
   a. Pre-machine and reinforce frame members for hardware in accordance with manufacturer's standards and door hardware schedule.
   b. Surface mounted closures will be reinforced for but not prepped or installed at factory.
8. Anchors:
   a. Fiberglass masonry t anchor.

2.4 Face Sheet.

A. Standard Interior and Exterior Class C 0.120” thick, Sandstone texture, through color FRP sheet.
1. Flexural Strength, ASTM-D790: 27 x 103 psi.
2. Flexural Modulus, ASTM-D790: 0.7 x 106 psi.
3. Tensile Strength, ASTM-D638: 18 x 103 psi.
4. Tensile Modulus, ASTM-D638: 1.0 x 106 psi.
5. Barcol Hardness, ASTM-D2583: 40.
6. Izod Impact, ASTM-D256: 7.0 ft-lb/in.
7. Gardner Impact Strength, ASTM-D5420: 30 in-lb.
8. Water Absorption, ASTM-D570: 0.16%/24hrs at 77°F.
9. Surface Burning, ASTM-E84: Flame Spread ≤ 200, Smoke Developed ≤ 450.
10. Chemical Resistance.
    a. Excellent Rating.
       1) Acetic Acid, Concentrated.
       2) Acetic Acid, 5%.
       3) Bleach Solution.
       4) Detergent Solution.
       5) Distilled Water.
       6) Ethyl Acetate.
       7) Formaldehyde.
       8) Heptane.
       9) Hydrochloric Acid, 10%.
       10) Hydrogen Peroxide, 3%.
       11) Isooctane.
       12) Lactic Acid, 10%.

B. Door Core.
1. Density, ASTM-D1622: ≤ 5.0 pcf.
2. Compressive Properties, ASTM-D1621: Compressive Strength ≥ 60 psi, Compressive Modulus ≥ 1948 psi.
3. Tensile and Tensile Adhesion Properties, ASTM-D1623: Tensile Adhesion, 3” x 3” FRP Facers ≥ 53 psi, Tensile Adhesion, 1” x 1” Foam ≥ 104 psi.
4. Thermal and Humid Aging, ASTM-D2126: Volume Change at 158 °F, 100% humidity, 14 days ≤ 13%.
5. Thermal Conductivity, ASTM-C518, Thermal Resistance ≥ 0.10 m2K/W.

C. 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.

D. 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.

2.5 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.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.7 FINISHES

A. Door.
1. FRP Face Sheets
a. Through color.
1) As selected by architect from manufacturers standard colors.

B. Frame
1. Through color FRP
a. As selected by architect from manufacturers standard colors.

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 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.

3.3 FIELD QUALITY CONTROL

A. Manufacture's Field Services.
   1. Manufacturer's representative shall provide technical assistance and guidance for installation of doors.

3.4 ADJUSTING

A. Adjust doors, hinges, and locksets for smooth operation without binding.

3.5 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.

3.6 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 43

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Schedules shall be kept current with all changes to the project. If changes occur, project hardware schedules shall be maintained to reflect the changes as they are approved. Omitted items shall be deleted from openings, added and replaced items shall be included. Installation submittals shall be kept current as changes occur. Upon request, a complete updated hardware schedule shall be provided to the contractor. Supplemental submittals that include only the changed openings will not be acceptable.

C. Prior to final payment, provide a record copy of hardware schedules, including all revisions and updates. All openings shall be listed to reflect final installed configuration only.

D. Other Action Submittals:
   1. Door Hardware Schedule: Prepared by or under the supervision of Installer, detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
   2. Submittal Sequence: Submit door hardware schedule concurrent with submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
   3. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
   4. Format: Use same scheduling sequence and format as in the Contract Documents.
   5. Content: Include the following information:
      a. Identification number, location, hand, fire rating, size, and material of each door and frame.
      b. Locations of each door hardware set cross-referenced to Drawings on floor plans and to door and frame schedule.
      c. Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
      d. Description of electrified door hardware sequences of operation and interfaces with other building control systems.
      e. Fastenings and other pertinent information.
      f. Explanation of abbreviations, symbols, and codes contained in schedule.
      g. Mounting locations for door hardware.
      h. List of related door devices specified in other Sections for each door and frame.
   6. Keying Schedule: Prepared by or under the supervision of Installer, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and Architectural Hardware Consultant.

B. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.

C. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
   1. Scheduling Responsibility: Preparation of door hardware and keying schedules.

B. Hardware Supplier Qualifications: The hardware supplier must be a corporate member in good standing of The Door and Hardware Institute (DHI), employing at least one Architectural Hardware Consultant (AHC) who is currently participating in DHI's continuing education program (CEP).

C. Source Limitations: Obtain each type of door hardware from a single manufacturer.

D. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

E. Accessibility Requirements: For door hardware on doors in an accessible route, comply with ICC/ANSI A117.1 and IAC - Illinois Accessibility Code, latest version.
   1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
   2. Comply with the following maximum opening-force requirements:
      a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
   3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
   4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

F. Preinstallation Conference: Conduct conference at Project site.
   1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
   2. Inspect and discuss preparatory work performed by other trades.
   3. Review sequence of operation for each type of electrified door hardware.
   4. Review required testing, inspecting, and certifying procedures.

G. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent

the use of types specified, hardware shall be furnished of suitable types having as nearly as practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.

B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.

C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.

D. Deliver keys to Owner by registered mail or overnight package service.

1.7 COORDINATION

A. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

B. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
   2. Structural failures including excessive deflection, cracking, or breakage.
   3. Faulty operation of doors and door hardware.
   4. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
   5. Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.
   6. Exit Devices: Two years from date of Substantial Completion.
   7. Manual Closers: Ten years from date of Substantial Completion.

B. Factory direct order number shall be provided for each shipment of locks, closers and exit devices with warranty, prior to final payment.

1.9 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
   1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:
   1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.
   2. References to BHMA Designations: Provide products complying with these designations and requirements for description, quality, and function.

2.2 HINGES

A. Hinges: BHMA A156.1.
   1. Hinge Base Metal: Unless otherwise indicated, provide the following:
      a. Exterior Hinges: Stainless steel, with stainless steel pin.
   2. Number of Hinges:
      a. Provide not less than 3 hinges per door leaf for doors 90 inches or less in height and one additional hinge for each 30 inches of additional height.
   3. Size of Hinges
      a. Provide standard weight (.134” thick) 4-1/2” x 4-1/2” ball bearing hinges on all doors up to and including 3’-0” in width. Over 3’-0” in width provide extra heavy weight ball bearing hinges (.180” thick) 4-1/2” x 4-1/2”.
   4. Hinge options:
      a. Provide non removable pins at exterior openings and outswinging interior doors.
   5. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Hager Companies.
      b. McKinney.
      c. Stanley Commercia Hardware, a Domakaba Company.

2.3 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Bored Locks: Minimum 1/2-inch latchbolt throw.

C. Lock Backset: 2-3/4 inches, unless otherwise indicated.

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim and aluminum frames.

3. Aluminum-Frame Strike Box: Manufacturer's special strike box fabricated for aluminum framing.
4. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

E. Bored Locks: BHMA A156.2; Series 4000; Grade 1.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Sargent.
b. Best Access Solutions, a Dormakaba Company.
c. Corbin Russwin
d. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.4 LOCK CYLINDERS

A. Lock Cylinders: BHMA A156.5, Grade 1.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Best Lock.
b. Sargent
2. No alternate manufacturers will be accepted without architect's approval prior to bidding.

2.5 KEYING

A. Keying System: Factory registered, complying with guidelines in BHMA A156.28, Appendix A. Incorporate decisions made in keying conference.
1. Existing System:

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

B. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.

C. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.

D. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 92 .00 "Joint Sealants."

E. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

F. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.

G. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.3 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

3.4 CLEANING AND PROTECTION

A. Clean adjacent surfaces soiled by door hardware installation.

B. Clean operating items as necessary to restore proper function and finish.

C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 01 79 .00 "Demonstration and Training."

3.6 DOOR HARDWARE SCHEDULE

END OF SECTION 08 71 00

SECTION 09 77 00 - REINFORCED FIBERGLASS WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fiberglass reinforced panels at ceiling.

1.2 REFERENCES

A. General: Standards listed by reference, including revisions by issuing authority, form a part of this specification section extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

B. ASTM International:
   1. ASTM D2583 Standard Test method for Indentation hardness of Rigid Plastics by Means of a Barcol Impressor.
   2. 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).
   3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.3 SUBMITTALS

A. Product Data: Submit product data, including manufacturer's SPEC-DATA product sheet, for specified products.

B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including anchorage, accessories, finish colors, patterns and textures. Indicate location and dimension of joints and fastener attachment.

C. Samples: Submit selection and verification samples for finishes, colors and textures.

D. Quality Assurance Submittals: Submit the following:
   1. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.
   2. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.
   3. Manufacturer's Instructions: Manufacturer's installation instructions.

E. Closeout Submittals: Submit the following:
   1. Operation and Maintenance Data: Operation and maintenance data for installed products. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
   2. Warranty: Warranty documents specified herein.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Installer Qualifications: Installer should be experienced in performing work of this section and should have specialized in installation of work similar to that required for this project.

2. Manufacturer Qualifications: Manufacturer should be capable of providing field service representation during construction and should be capable of approving application method.

1.5 DELIVERY, STORAGE & HANDLING

A. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identifications labels intact. Package sheets on skids or pallets for shipment to project site.

B. Handling: Remove foreign matter from face of panel by using a soft bristle brush, avoiding abrasive action.

1.6 PROJECT CONDITIONS

A. Environmental Requirements:
1. Provide ventilation to disperse fumes during application of adhesive as recommended by adhesive manufacturer.

B. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.7 WARRANTY

A. Special Warranty: 10 years commencing on date of Substantial Completion. Provide written manufacturer's 10 year limited warranty stating panels will be free from substantial defects in material and workmanship and will not rust, rot, corrode or develop structural surface cracks or require painting or refinishing.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Crane Composites, Inc. /Kemlite.

B. Sequentia Products.

C. Nudo Products, Inc.

2.2 MANUFACTURED UNITS

A. Ceiling Panels: Basis-of-Design Product: NUDO NuFiber Impact and Moisture Resistant Wall and Ceiling Panel
1. Rating: Class III C Interior Finish.
2. Ceiling Panels: Finish, thickness and color shall be:
a. Substrate: 19/32" Fir exterior plywood.
b. Face Sheet: Pebbled 0.030 inch FRP Color: 50 white.
3. Performance Properties: Provide products with the following properties:
a. Class C flamespread of 200 or less, smoke developed of 450 or lower per ASTM E84 latest version.

2.3 ACCESSORIES

A. Adhesive: Provide panel adhesive as recommended by panel manufacturer.

2.4 SOURCE QUALITY

A. Source Quality: Obtain fiberglass reinforced plastic (FRP) panels form a single manufacturer. Provide panels and molding only from manufacturer specified to ensure warranty and color harmonization of accessories.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 INSTALLATION

A. Composite Fiberglass Reinforced Panel (FRP) Installation:
   1. Cut and drill panels with carbide tipped saw blades or drill bits.
   2. Install panels with manufacturer's recommended gap for panel field and corner joints.
   3. Adhere wall panel system. Follow adhesive manufacturer's recommendations.
   4. Use products acceptable to panel manufacturer and install FRP system in accordance with panel manufacturer's printed instructions.

3.3 CLEANING

A. Cleaning: remove temporary coverings and protection of adjacent work areas. Repair or replace products that have been installed and are damaged. Clean installed products in accordance with manufacturer's instructions prior to owner's acceptance. Remove construction debris from project site and legally dispose of debris.
   1. Remove any adhesive or excessive sealant from panel face using solvent or cleaner recommended by panel manufacturer.

END OF SECTION 09 77 00

SECTION 09 91 00 - PAINTING

PART 1 - PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials for Painting and Finishing.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit 8-1/2 x 11 color downs on heavy paper to match Architect's color chips for each color and type of paint specified for Architect's approval.
      a. Architect will furnish a schedule after beginning of construction. The schedule will include color chips for matching.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Material Certificates: For scrub resistance and washability, signed by manufacturers.

1.3 QUALITY ASSURANCE

A. Architect has the option of requesting test patches in place for Architect's approval of final color and finish.
   1. Notify Architect 48 hours in advance of the time the test patches will be ready for inspection.

B. Manufacturer shall certify that tests have been performed on semi-gloss wall finish and others as selected by the Architect. Acceptance of materials is conditional upon demonstration of washability and abrasion resistance of test patches. Testing shall include the following:
   1. Scrub resistance per ASTM D2486-79: Value as specified in approved finish schedule but not less than 1200.
   2. Washability per ASTM D3450-80: Value as specified in approved finish schedule but not less than 80% for sponge and 90% for brush.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).
   1. Maintain containers in clean condition, free of foreign materials and residue.
   2. Remove rags and waste from storage areas daily.
      a. Do not store oil or paint soaked rags inside the building.
   3. Do not store materials in any room containing a direct-fired heating unit.

B. Mix and thin paints in strict accordance with recommendations of the manufacturer.
   1. Mix paints only in areas designated, and provided proper protection for walls and floors.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply interior paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

C. Do not apply exterior paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

PART 2 - PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce manufacturer and product lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.3 COLORS

A. The Architect has the option of accenting certain building elements different colors; (i.e.: doors, frames, columns, ceilings, walls) to be defined in a Schedule.

B. The Architect reserves the right to select colors from manufacturer's standard or premium price groups, including deep tone colors for both interior and exterior products.

C. Furnish an equal product by the same manufacturer only in those instances where a deep tone color specified by the Architect is not available in the specified product. This is subject to Architect's approval.

D. Tinted primer shall be used whenever deep tone colors are specified.

2.4 INTERIOR FINISHES

A. Exposed wood and trim - Epoxy:
   1. First Coat:
      a. Benjamin Moore: Ultra Spec 500 Interior Latex Primer N534
      b. PPG Glidden: High Hide Interior Primer Sealer 1000-1200.
      c. PPG Paints:4-603 Permacrete interior/exterior Acrylic Alkali Resistant Primer for plaster; 6-2 Interior Latex Sealer for gypsum board.
      d. Pratt & Lambert: Plaster: Pro Hide Gold Z1001 Gypsum: Pro Hide Gold High Holdout Latex Primer/Sealer Z8165.
      e. Sherwin Williams: ProMar 200 Zero VOC Primer B28W2600 Series

2. Second and Third Coats:
    a. Benjamin Moore: Corotech Pre-Catalyzed Waterborne Wall Epoxy Eggshell V342
    b. PPG Paints: 16-551 Series, Pitt-Glaze High Solids Acrylic-Epoxy.
    c. Pratt & Lambert: Acrylic Water-Based Epoxy Z7021.
    d. Sherwin Williams: Pro Industrial Water Based Catalyzed Epoxy, B73 Series (EgShel, B73-360 Series or Gloss, B73-300-Hardener B73V00300)

B. Masonry Block
1. First Coat: Masonry block filler at rate not to exceed 100 sq. ft. per gal.
    a. Benjamin Moore: Ultra Spec Masonry Int/Ext High Build Block Filler 571
    b. PPG Glidden: Concrete Coatings Block Filler Interior/Exterior Primer 3010-1200.
    c. PPG Paints: Speedhide Latex Block Filler 6-15XI
    d. Pratt & Lambert: Pro Hide Silver Block Filler Z8485
    e. Sherwin Williams: PrepRite Block Filler B25W25 Series
2. Second and Third Coats - Epoxy.
    a. PPG Paints: 16-551 Series, Pitt-Glaze High Solids Acrylic-Epoxy.
    b. Pratt & Lambert: Acrylic Water-Based Epoxy Z7021
    c. Sherwin Williams: Pro Industrial Water Based Catalyzed Epoxy Gloss, B73 Series (EgShel, B73-360 Series or Gloss, B73-300 - Hardener, B73V00300)

C. Concrete Floors – Opaque Sealer:
1. Preparation:
    a. Surfaces shall be clean and dry.
    b. Mechanically abrade surface to achieve a texture of medium grade sandpaper.
    c. Clean surfaces per ASTM Standard Practice D4258-83.
2. First Coat and Second Coat:
    a. Benjamin Moore: Insl-X Tuffcrete Waterborne Acrylic Concrete Stain CST-2xxx
    b. Sherwin Williams: H&C Colortop Stain Solid Color Water-Based, or PPG Perma-Crete Color Seal WB Interior/Exterior Acrylic Concrete Stain.
    c. Apply minimum of 2 coats in strict accordance with manufacturer's written instructions.

2.5 MECHANICAL

A. Apparatus, Equipment, and Equipment Supports
1. First Coat:
    a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
    b. PPG Paints: 4020PF Direct to Metal Primer & Flat Finish.Interior/ Exterior.
    c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
    d. Sherwin Williams: Pro Cryl Universal Acrylic Primer B66W01310 Series
2. Second Coat:
    a. Benjamin Moore: Ultra Spec 500 Interior Gloss N540
    b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
    c. Pratt & Lambert: Enducryl Acrylic Semi Gloss Z6621
    d. Sherwin Williams: Pro Industrial Acrylic Semi-Gloss B66W-650 Series.

B. Exposed Bare Piping, Valves, Fittings, and Hangers:
1. First Coat:
    a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
    b. PPG Paints: PittTech 4020PF Direct to Metal Primer & Flat Finish.
    c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
    d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
2. Second Coat:
    a. Benjamin Moore: Ultra Spec 500 Interior Gloss N540

b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Semi Gloss Z6621
d. Sherwin Williams: Pro Industrial Acrylic Semi-Gloss B66-650 Series.

C. Exposed Insulation Piping, Valves, Fittings, and Hangers when canvas wrapped:
1. First Coat:
a. Benjamin Moore: Insl-x STIX Waterborne Bonding Primer SXA-110
b. PPG Glidden Professional: High Hide Interior Primer Sealer 1000-1200.
c. PPG Paints: Speedhide Latex Primer-Sealer 6-2
d. Pratt & Lambert: Pro Hide Gold High Holdout Latex Primer Z8165
e. Sherwin Williams: ProMar 200 Zero VOC Primer B28W2600 Series
2. Second Coat:
a. Benjamin Moore: Ultra Spec 500 Interior Flat N536
b. PPG Glidden Professional: Ultra-Hide 150 Interior Flat Paint 1210V Series.
c. PPG Paints: Speedhide Latex Interior Flat 6-70
d. Pratt & Lambert: Pro Hide Gold Flat Z8100
e. Sherwin Williams: ProMar 200 Zero VOC Flat B30 Series.

D. Insulated Ductwork and Piping with Canvas Covering Inc. Hangers for any kind of ductwork.
1. One Brush Coat:
a. PPG Paints: 42-7, Speedhide Interior Fire Retardant Flat Latex.

E. Grilles, Registers, and Diffusers
1. First Coat:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66w01310 Series.
2. Second and Third Coats:
a. Benjamin Moore: Ultra Spec 500 Interior Gloss N540
b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Semi Gloss Z6621
d. Sherwin Williams: Pro Industrial Acrylic Semi-Gloss, B66 Series.

2.6 ELECTRICAL

A. Exterior Exposed Electrical Conduit Fittings, Boxes, and other miscellaneous exterior electrical items.
1. First Coat - Galvanized:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
2. First Coat - Ferrous Metal:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
3. Second and Third Coats:
a. Benjamin Moore: Ultra Spec HP DTM Acrylic Gloss Enamel HP28
b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Gloss Z6611

d. Sherwin Williams: Pro Industrial Acrylic Gloss, B66 Series (Semi-Gloss, B66-1100 / Gloss, B66-100 Series)

B. Interior Exposed Electrical Items in areas where walls and/or ceilings are painted including electrical panels, cabinets, exposed conduit, etc.
   1. First Coat - Galvanized:
      a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
      b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
      c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
      d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
   2. First Coat - Ferrous Metal:
      a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
      b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
      c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
      d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
   3. Second and Third Coats:
      a. Benjamin Moore: Ultra Spec Interior Gloss Finish N540
      b. PPG Paint: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
      c. Pratt & Lambert: Enducryl Acrylic Gloss Z6611
      d. Sherwin Williams: Pro Industrial Acrylic Latex Semi-Gloss, B66 Series.

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.
   5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION OF NEW SUBSTRATES

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Ferrous Metals, Galvanized Metal, Aluminum: Clean surfaces according to the Steel Structure Painting Council Surface Preparation Specifications: SSPC-SP1 Solvent Cleaning, SSPC-SP2 Hand Tool Cleaning, or SSPC-SP3 Power Tool Cleaning, as appropriate.
   1. Steel Substrates: Remove any rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
   2. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
      a. Thoroughly clean galvanized metal per SSPC-SP1 with water soluble degreaser. No hydrocarbons.
   3. Aluminum Substrates: Remove surface oxidation.

F. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.

G. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. General: Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
      a. Except where specifically authorized by the Architect to do otherwise: Apply flat or eggshell wall paint by brush or roller; apply gloss or semi-gloss with brush only.
   2. Sanding: In addition to preparatory sanding, fine sand between succeeding coats of all varnish enamel or flat enamel, using sandpaper appropriate to the finish. Use fine production paper between coats.
   3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   5. Doors: Finish all edges, including tops and bottoms, of wood and metal doors same as faces. Fill edges of exposed plywood doors, panels, similar materials.
   6. Finish interior of all closets and cabinets same as adjoining rooms, unless otherwise scheduled.
   7. Apply one coat of sanding sealer and one coat of semi-gloss varnish to insides of all drawers unless otherwise specified.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. The number of coats scheduled are minimums.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
   1. Holidays and restrikes in painted surfaces shall be considered sufficient cause to require recoating of entire surface.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
   1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance of paint materials with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 00

SECTION 09 92 00 – FACILITY PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes all surface preparation, field painting and finishing of exposed interior and exterior items and surfaces of equipment and piping systems provided.

B. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified under other Sections.

C. Paint exposed surfaces whether or not substrate is designated in schedules but would normally be painted, except where a surface or material is specifically indicated not to be painted or is to remain natural. Where an item or surface is not specifically mentioned, paint the same as similar adjacent materials or surfaces. If color or finish is not designated, OWNER will select from standard colors or finishes available.

D. Painting includes field painting exposed bare and covered pipes and ducts (including color coding), hangers, exposed steel and iron work, and primed metal surfaces of mechanical and electrical equipment.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.

B. For any listed paint system where the installer or manufacturer believes the specified system is incompatible or not the best system for the substrate and installation conditions indicated, bring these concerns to the architect's attention for discussion and resolution before making product submittals.

C. For any listed paint system where the film thickness is not indicated or where the installer / manufacturer recommends a different thickness, clearly indicate the thickness intended and clearly point out differences from the specified system. Architect will accept or correct proposed changes in the submission.

D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat.
   1. Submit Samples on rigid backing, 12 inches square.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.
   5. Acceptance of verification sample colors is tentative, pending final color review on in-place mockups under actual installation conditions.

E. Product List: For each product indicated, include the following:
   1. Cross-reference to paint system and locations of application areas. Use same designations indicated on Drawings and in schedules.

F. Qualification Data: For Applicator.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for flame and smoke rating requirements for finishes.

B. All chemicals, substances, and materials added to or brought in contact with water in or intended to be used in a public water system or used for the purpose of treating, conditioning, altering, or modifying the characteristics of such water shall be shown by either the manufacturer, distributor, or purveyor to be non-toxic and harmless to humans when used in accordance with the formulation and concentration as specified by the manufacturer, and shall conform with the American National Standards Institute/National Sanitation Foundation (ANSI/NSF) Standard 60 or 61. Any organization certified by the American National Standards Institute may certify in writing that a product conforms with these standards. Product labels shall bear the NSF Listing Mark.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to Site in sealed and labeled containers; inspect to verify acceptability.

B. Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Store paint materials at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F in a ventilated area, and as required by manufacturer's instructions.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

C. Minimum Application Temperatures for Latex Paints: 50 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions. Surface temperature must be at least 5 degrees F greater than the dew point.

D. Minimum Application Temperature for Varnish and Similar Finishes: 50 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions. Surface temperature must be at least 5 degrees F greater than the dew point.

E. Provide lighting level of 80 foot candles measured mid-height at substrate surface. Refer to SSPC-Guide 12, Guide for Illumination of Industrial Painting Projects for additional guidelines.

1.6 QUALITY ASSURANCE

A. Applicator Qualifications: A firm or individual experienced in applying paints and coatings similar in material, design, and extent to those indicated for this Project, whose work has resulted in applications with a record of successful in-service performance.

B. Source Limitations: Obtain block fillers and primers for each coating system from the same manufacturer as the finish coats.

1.7 PROJECT CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

1.8 EXTRA MATERIALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Quantity: Furnish an additional 5 gallons of the primary neutral color and 1 gallon of each other color applied.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Carboline Company.
   2. Devoe High Performance Coatings.
   3. PPG (Pittsburg Paints) High Performance Coatings.
   4. The Sherwin-Williams (SW) Company.
   5. Tnemec Company, Inc.

2.2 MATERIALS

A. Material Compatibility: Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.

B. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

C. Coatings: Ready-mixed, except field-catalyzed coatings. Process pigments to a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating; good flow and brushing properties; capable of drying or curing free of streaks or sags.

D. Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified of commercial quality. Use products compatible with painting materials and approved by paint manufacturer.

E. Paint materials and equipment shall be compatible in use.

F. Primer, Intermediate, and Finish coats shall all be from the same coatings manufacturer. Prime coats shall be compatible with and appropriate for use on surface to be coated.

2.3 COLORS

A. Colors, if not indicated in Painting Schedule in Part 3, will be selected by OWNER from manufacturer’s standard colors.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready for application of materials in accordance with the product manufacturer's instructions.

B. Examine surfaces scheduled to be finished prior to commencement of Work. Report any condition that may potentially affect proper application.

C. Measure moisture content of surfaces using appropriate method as instructed by the coating manufacturer. Do not apply finishes unless moisture content of surfaces is below the coating manufacturer's acceptable maximums.

3.2 TESTING OF PAINT ON EXISTING SURFACE FINISH

A. Where paint is to be applied over existing finished surface, apply a test application.

B. Allow test application to dry overnight. If wrinkling or lifting occurs after overnight drying, application of new paint over existing finished surface will not be allowed. With approval of ENGINEER, use one of the following alternatives:
   1. Remove existing coating and apply complete system as described in Paint Schedule Article 3.9.
   2. Apply intermediate barrier coat material that is compatible with both the existing finish and the new topcoat and will ensure bonding of new paint to existing surface finish.
   3. Substitute a different coating material that is compatible with and will adhere to existing surface finish.

C. Cost of test application shall be borne by CONTRACTOR.

3.3 PREPARATION

A. Prior to abrasive blasting, all electrical equipment shall be protected and sealed. All adjacent work shall be protected. All abrasive blasting debris shall be removed and the facility thoroughly cleaned prior to applying mid and top coats.

B. Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing. Mask nameplates, descriptive data on pumps, motors and other equipment. Removed item shall be reinstalled by workmen skilled in the trades involved.

C. Correct defects and clean surfaces which affect Work of this Section.

D. Remove existing coatings that exhibit poor adhesion or unacceptable surface defects.

E. Seal marks which may bleed through surface finishes with sealer as instructed by paint manufacturer.

F. If mildew is encountered, remove by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high pressure water. Remove oxidation with acid etch and solvent washing. Apply manufacturer's instructed primer immediately following cleaning.

H. Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply compatible sealer or primer.

I. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

J. Concrete: Concrete surfaces shall be fully aged. Loose, powdery, crumbly concrete shall be dressed down to a firm, sound, hard substrate.
   1. For light duty service, remove contamination in accordance with ASTM D4258 Standard Practice for Surface Cleaning Concrete for Coating.
   2. For heavy duty service such as continuous and intermittent immersion, mechanical loading, or for protective coating systems, achieve surface profile CSP 1-9 by acid etching per ASTM D4260, or by mechanical abrasion per ASTM D4259. Refer to ICRI 310.2 for sample chips of CSP 1-9 profile.

K. Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply manufacturer's primer as instructed immediately following cleaning.

L. Where surfaces are coated with bituminous coating that is not compatible with paint material, remove bituminous coating with abrasive blasting.

M. Galvanized Steel Surfaces: Remove surface contamination and oils and wash with solvent. Do not use hydrocarbon solvents if applying waterborne coatings. Apply manufacturer's instructed primer.

N. Uncoated Steel Surfaces:
   1. Welded areas shall be ground smooth per NACE Standard RP 0178.
   2. Use abrasives for blast cleaning that are clean, uniformly graded, and free of oil, soluble salts, chlorides, or foreign matter which could contaminate the blasted surface. Size the abrasive to produce an anchor pattern profile height as required by the coating manufacturer.
   3. Steel surfaces to be painted and not factory-primed, shall be field abrasive-blasted in accordance with NACE-3 (SSPC-SP6), commercial blast for non-immersion service; and in accordance with NACE-2 (SSPC-SP10), near-white blast for immersion service, unless a higher degree of surface preparation is required by the manufacturer.

O. Shop-Primed Steel Surfaces:
   1. For non-submerged steel surfaces, clean surfaces in accordance with SSPC-SP1 Solvent Cleaning, and remove loose primer and rust in accordance with SSPC-SP2 Hand Tool Cleaning or SSPC-SP3 Power Tool Cleaning. Feather edges to make touch-up patches inconspicuous. Prime bare steel surfaces.
   2. Retouch damaged areas of shop-primed items with compatible primer.
   3. CONTRACTOR shall be responsible for compatibility of shop primer with field-finish coats.
   4. For metal surfaces in a submerged, vapor, or splash zone, remove shop primer if incompatible with field finish coats, and blast clean to SSPC-SP10 Near-White Blast Clean. Apply primer as specified.

P. Ductile Iron and Cast Ductile Iron Surfaces:
   1. Ductile iron and cast ductile iron surfaces to be painted shall be prepared using the National Association of Pipe Fabricators, Inc. (NAPF) Surface Preparation Standards NAPF 500-03, and **not** according to SSPC / NACE Standards for preparation of steel surfaces.
   2. Remove grease and oil using NAPF Standard 500-03-01 Solvent Cleaning.
   3. For interior, non-submerged locations use NAPF 500-03-02 Hand Tool Cleaning and NAPF 500-03-03 Power Tool Cleaning as recommended by paint manufacturer.
   4. For submerged, exterior, or vapor or splash zone use NAPF 500-03-04 Abrasive Blast Cleaning for Ductile Iron Pipe and Fittings, and NAPF 500-03-05 Abrasive Blast Cleaning for Cast Ductile Iron Fittings

Q. Plastic and Fiberglass: Solvent-wipe and scuff sand; apply test sample prior to application to ensure adhesion. CAUTION: Do not use hydrocarbon containing solvents when using waterborne topcoats.

3.4 APPLICATION

A. Do not apply materials until representative samples of surface preparation are approved by ENGINEER and an authorized representative of the manufacturer.

B. Comply with manufacturer's instructions.

C. Do not thin materials, except to comply with manufacturer's instructions.

D. Apply coatings to all surfaces with special attention to hard-to-reach areas such as between the legs of back-to-back angles. Apply each coat to achieve the specified dry film thickness.

E. Do not apply finishes to surfaces that are not dry.

F. Deficiencies in film or coating thickness shall be corrected by the application of additional coat(s) of material at the expense of CONTRACTOR.

G. Apply each coat to a uniform smooth finish.

H. Special attention shall be given to ensure that edges, corners, crevices and welds, receive a film or coating thickness equivalent to that of adjacent surfaces. At no time will wet-on-wet applications be permitted. The finished surfaces shall be free from runs, drips, ridges, waves, laps, brush marks and variations in color, texture and finish.

I. Apply each coat of paint slightly darker than the preceding coat unless otherwise approved.

J. Sand surfaces lightly between coats as required to achieve required finish.

K. Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

3.5 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

A. Paint shop-primed equipment.

B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

C. Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are pre-finished.

D. Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets to match face panels.

E. Paint exposed conduit and electrical equipment occurring in finished areas.

F. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

G. Color-code equipment, piping, conduit, and exposed ductwork in accordance with requirements indicated. Color band and identify with flow arrows names and numbering.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.6 NON-POTABLE SUBMERGED AND INTERMITTENTLY SUBMERGED METAL

A. Spray application is necessary to obtain required film thickness. Spray application shall be made in cross hatches to achieve required dry film thickness. Brush or roller application will require additional coats to obtain the required film thickness at no additional expense to Owner. Additional coats to meet the dry film thickness requirements must be applied within 24 hours of application of first coat of coal-tar epoxy. Contractor shall provide adequate protection of adjacent areas to protect against overspray

3.7 FIELD QUALITY CONTROL

A. Wet Film Thickness: Monitor during application of each successive coat.

B. Dry Film Thickness: Measure the thickness of each coat applied using non-destructive dry film thickness gages. Calibrate gages and perform thickness measurements in accordance with SSPC-PA2. Disputes regarding coating thickness applied shall be resolved by use of a Tooke Gage (destructive scratch gage) to the extent required. Repair damage created by destructive testing using the complete coating system specified.

C. Inspection Devices: CONTRACTOR shall possess, use, and make available for use by OWNER, inspection devices in good working order for dry film thickness measurement. Furnish with the inspection device, U.S. Department of Commerce, National Bureau of Standards certified thickness calibration plates to verify accuracy of the dry film thickness gages.

D. Curing of Coatings: Cure coatings in accordance with manufacturer's instructions. Test for adequacy of cure by ASTM D5402 Double Rub Method using solvent MEK, or other solvent or test acceptable to coating manufacturer. Use NSF approved test materials when coating will be in contact with potable water.

3.8 CLEANING

A. Collect waste material which may constitute a fire hazard; place in closed metal containers and remove daily from Site.

B. Remove masking, over-spray, or drips on adjacent surfaces.

3.9 PAINT SYSTEM SCHEDULE

A. Unless otherwise specified, paint systems of The Sherwin-Williams (SW) Company are listed. Equivalent systems of other manufacturers specified in Article 2.1 are acceptable. All paint systems require submittal approval.

SUBSTRATE		DESCRIPTION	DRY MILS
A. CONCRETE – SUBMERGED, SPLASH OR VAPOR ZONE (POTABLE WATER)	Prime Coat	Macropoxy 646 PW, B58 Series Color, B58VX600 Hardener	5 – 10
	First Coat	Macropoxy 646 PW, B58 Series Color, B58VX600 Hardener	5 – 10
	Second Coat	N/A	
	Final DFT		10 – 20
	NOTE: ONLY AVAILABLE IN MILL WHITE AND LIGHT BLUE		
B. STEEL or IRON – EXTERIOR NON-SUBMERGED	Prime Coat	Dura-Plate 235 Multi-Purpose Epoxy B67-235 B67V235 Hardener	4 – 6
	First Coat	Dura-Plate 235 Multi-Purpose Epoxy B67-235 B67V235 Hardener	4 – 6
	Second Coat	Hi-Solids Polyurethane B65-300 Series Color, B60V30 Hardener or Acrolon 218 HS Acrylic Polyurethane B65-600 Series B65V600 Hardener	3 – 4
	Final DFT		11 – 16
C. STEEL or IRON – INTERIOR NON-SUBMERGED	Prime Coat	Recoatable Epoxy Primer, B67Series, B67V5 Hardener	3 – 6
	First Coat	Macropoxy 646 FC, B58Series, B58V600 (semi gloss)	3 – 5
	Second Coat	Macropoxy 646 FC, B58Series, B58V600 (semi gloss)	3 – 5
	Final DFT		9 – 16
	NOTE: PRIMER ONLY AVAILABLE IN GRAY, TAN, AND RED OXIDE		
D. METAL – SUBMERGED, SPLASH OR VAPOR ZONE (NON-POTABLE WATER)	Surface Preparation	Near-White Blasting SSPC-SP-10	
	Prime Coat	Polyamide Epoxy • Tnemec: Series 66-1211 HI-Build Tneme-Tar • Carboline: Bitumastic 300M • PPG Coal Cat Polyamide Cure Coal-Tar Epoxy 97-640	3 – 6
	First Coat	Polyamide Epoxy – Coal Tar • Tnemec: Series 46-413 HI-Epoxoline Primer • Carboline: Bitumastic 300M • Sherwin-Williams: Targuard Coal Tar Epoxy B69B60/B69V60 • PPG Coal Cat Polyamide Cure Coal-Tar Epoxy 97-640	5 – 6

SUBSTRATE		DESCRIPTION	DRY MILS
	Second Coat	Polyamide Epoxy – Coal Tar • Tnemec: Series 46-413 HI-Epoxoline Primer • Carboline: Bitumastic 300M • Sherwin-Williams: Targuard Coal Tar Epoxy B69B60/B69V60 • PPG Coal Cat Polyamide Cure Coal-Tar Epoxy 97-640	5 – 6
	Final DFT		13 – 18
E. METAL – SUBMERGED, SPLASH OR VAPOR ZONE (POTABLE WATER)	Surface Preparation	Near-White Blasting SSPC-SP-10	
	Prime Coat	Macropoxy 646 PW, B58 Series Color, B58VX600 Hardener	3 – 6
	First Coat	Macropoxy 646 PW, B58 Series Color, B58VX600 Hardener	5 – 6
	Second Coat	Macropoxy 646 PW, B58 Series Color, B58VX600 Hardener	5 – 6
	Final DFT		13 – 18
	NOTE: ONLY AVAILABLE IN MILL WHITE AND LIGHT BLUE		
F. PLASTIC AND FIBERGLASS	Prime Coat	DTM Bonding Primer, B66-A50 Series	2 – 5
	First Coat	DTM Acrylic Gloss Coating, B66-100 Series	2.5 – 4
	Second Coat	DTM Acrylic Gloss Coating, B66-100 Series N/A	2.5 – 4
	Final DFT		7 – 13
G. INSULATED PIPING (Interior only)	Prime Coat	ProMar 200 Latex Wall Primer, B28W08200	1 – 2
	First Coat	Metalatex Semi-Gloss Coating, B42 Series Color	1.5 – 4
	Second Coat	N/A	
	Final DFT		2.5 – 6

3.10 PAINTING SCHEDULE

A. The following indicates the surfaces to be painted using the materials previously specified in Article 3.9 for the type of surface and conditions of service. The painting of piping includes the painting of insulated piping, the painting of all appurtenances in the respective piping lines (valves, operators, metal supports, etc.) and the painting of valves, sluice gates, floor stands, operators, wall castings and other items not installed directly in a pipe line. The painting of electrical conduits includes the painting of all appurtenances in the respective conduit runs (boxes, etc.). Where new piping connects to existing piping, extend the painting to the end of the existing piping at walls, pumps, fixtures, and other terminations.
   1. Ductile iron piping
   2. Valves (do not cover nameplates)

B. The following indicates the colors to be used for the painting of piping and electrical conduits:
   1. Piping Color Code:
      a. Raw water: Green or Olive Green
      b. Exterior water well blow off: Light Brown or As Specified by Owner.
      c. Gas: Yellow
   2. Conduit and electrical enclosure color code:
      a. Paintable materials: match adjacent wall
      b. Do not paint stainless steel

END OF SECTION 09 92 00

SECTION 10 44 00 - FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Fire Extinguishers.
   2. Accessories

1.2 REFERENCES

A. Reference Standards:
   1. National Fire Protection Association (NFPA):
      a. NFPA 10-2010, Standard for Portable Fire Extinguishers: For criteria covering installations for Class A, B, C, D, and K hazards as well as the selection, inspection, maintenance, recharging, and testing of portable fire extinguishing equipment.
      b. Underwriters Laboratories, Inc. (UL)

1.3 ACTION SUBMITTALS

A. Product Data:
   1. Extinguishers: Materials description for fire extinguishers; include ratings and classifciations.
   2. Installation instructions for each product specified

1.4 INFORMATIONAL SUBMITTALS

A. Sample warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide products by J.L. Industries, Minneapolis, Minnesota, as indicated below or on drawings or a comparable product by one of the following:
   1. Larsen’s Manufacturing Company, Minneapolis, Minnesota.
   2. Profile International, Inc., Eden Prairie, Minnesota.
   3. The Ansul Company, Marinette, Wisconsin.
   4. Buckeye Fire Equipment Company, Kings Mountain, North Carolina.
   5. The Fyr-Fyter Co., Dayton, Ohio.

2.2 GENERAL

A. Designation numbers appearing on the drawings refer to the following:
   1. FE:Fire extinguisher and wall bracket

2.3 FIRE EXTINGUISHERS

A. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder: nonconductive and nontoxic.

1. Construction: Heavy duty steel cylinder with metal valve and siphon tube, O-ring seal, replaceable valve stem seal, visual pressure gage, pull pin and upright squeeze grip.
2. Finish: Factory powder-coated: Red.
3. Effectiveness (Rating): Class A, B, and C fires.
4. Cylinder shall be 10 pound size U/L rating 4A:60B:C approximately 20 inches high x 5 inches diameter with a range of 15 to 21 feet.
5. Model Identification and UL Rating: Cosmic 10E; 4A-80BC.

2.4 ACCESSORIES

A. Wall Brackets: Shall be designed to fit extinguishers and shall hold extinguishers firmly and securely in place, but shall provide for easy removal.
   1. Model: MARK type.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed and semi-recessed cabinets will be installed, and blocking where surface mounted cabinets will be installed.
   1. Notify the Contractor in writing of conditions detrimental to proper and timely completion of the installation.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Fire extinguisher cabinets, fire extinguishers, and mounting brackets are to be installed at the locations indicated. Accomplish a neat and workmanline finished job, consistent with the requirements for the use of the equipment.

B. Fire extinguishers are the be fully charged and ready for use when building is turned over to the Owner. Extinguishers shall be certified as fully charged by an approved fire extinguisher service company and shall be tagged or labeled as such.

END OF SECTION 10 44 00

SECTION 22 13 16 - SANITARY WASTE AND VENT PIPING

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. PVC pipe and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water .

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 31 20 00 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

C. Install piping at indicated slopes.

D. Install piping free of sags and bends.

E. Install fittings for changes in direction and branch connections.

F. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
   1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
   2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
      a. Straight tees, elbows, and crosses may be used on vent lines.
   3. Do not change direction of flow more than 90 degrees.
   4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of waste piping in direction of flow is prohibited.

G. Lay buried building waste piping beginning at low point of each system.
   1. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream.
   2. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
   3. Maintain swab in piping and pull past each joint as completed.

H. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

I. Install steel piping according to applicable plumbing code.

J. Install aboveground PVC piping according to ASTM D 2665.

K. Install underground PVC piping according to ASTM D 2321.

L. Install engineered soil and waste and vent piping systems as follows:
1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.
2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

M. Install force mains at elevations indicated.

N. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary waste gravity-flow piping.
a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors.
1. Comply with requirements for sleeves specified in Section 22 05 17 "Sleeves and Sleeve Seals for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

B. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: , nonpressure transition couplings.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."
1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.

2. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
3. Install individual, straight, horizontal piping runs:
   a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
   b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
   c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.
4. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
5. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical runs of cast iron soil piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

F. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:
1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor .
6. Comply with requirements for cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.
   a. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.8 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.9 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
1. Solid-wall Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING 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. Section Includes:
   1. Cleanouts.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Shop Drawings:
   1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 INFORMATIONAL SUBMITTALS

1.6 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Plastic Wall Cleanouts :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. IPS Corporation.
      b. Sioux Chief Manufacturing Company, Inc.
      c. Zurn Industries, LLC.
   2. Size: Same as connected branch.
   3. Body: PVC.
   4. Closure Plug: PVC.
   5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install fixture air-admittance valves on fixture drain piping.

E. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
   1. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 23 09 23.12 - CONTROL 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. Section includes the following types of control dampers and actuators for DDC systems:
   1. Rectangular control dampers.
   2. General control-damper actuator requirements.
   3. Electric and electronic actuators.

1.3 DEFINITIONS

A. RMS: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product, including the following:
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Operating characteristics, electrical characteristics, and furnished accessories indicating process operating range, accuracy over range, control signal over range, default control signal with loss of power, calibration data specific to each unique application, electrical power requirements, and limitations of ambient operating environment, including temperature and humidity.
   3. Product description with complete technical data, performance curves, and product specification sheets.
   4. Installation instructions, including factors affecting performance.

1.5 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. ASME Compliance: Fabricate and label products to comply with ASME Boiler and Pressure Vessel Code where required by authorities having jurisdiction.

C. Delegated Design: Engage a qualified professional[engineer], as defined in Section 01 40 00 "Quality Requirements," to size products where indicated as delegated design.

D. Ground Fault: Products shall not fail due to ground fault condition when suitably grounded.

E. Environmental Conditions:

1. Provide electric control-damper actuators, with protective enclosures satisfying the following minimum requirements unless more stringent requirements are indicated. Electric control-damper actuators not available with integral enclosures, complying with requirements indicated, shall be housed in protective secondary enclosures.

F. Selection Criteria:
   1. Fail positions unless otherwise indicated:
      a. Outdoor Air: Closed.
   2. Dampers shall have stable operation throughout full range of operation, from design to minimum airflow over varying pressures and temperatures encountered.
   3. Two-position dampers shall be full size of duct or equipment connection unless otherwise indicated.

2.2 RECTANGULAR CONTROL DAMPERS

A. General Requirements:
   1. Unless otherwise indicated, use parallel blade configuration for two-position control, equipment isolation service, and when mixing two airstreams. For other applications, use opposed blade configuration.
   2. Factory assemble multiple damper sections to provide a single damper assembly of size required by the application.
   3. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.

B. Rectangular Dampers with Steel Airfoil Blades (integral with Louver):
   1. Performance:
      a. Leakage: AMCA 511, Class 1A. Leakage shall not exceed 3 cfm/sq. ft. against 1-in. wg differential static pressure.
      b. Pressure Drop: 0.06-in. wg at 1500 fpm across a 24-by-24-inch damper when tested according to AMCA 500-D, figure 5.3.
      c. Velocity: Up to 6000 fpm.
      d. Temperature: Minus 40 to plus 185 deg F.
      e. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
      f. Damper shall have AMCA seal for both air leakage and air performance.
   2. Construction:
      a. Frame:
         1) Material: ASTM A 653/A 653M galvanized-steel profiles, 0.06 inch thick.
         2) Hat-shaped channel with integral flanges. Mating face shall be a minimum of 1 inch.
         3) Width not less than 5 inches.
      b. Blades:
         1) Hollow, airfoil, galvanized steel.
         2) Parallel or opposed blade configuration as required by application.
         3) Material: ASTM A 653/A 653M galvanized steel, 0.05 inch thick.
         4) Width not to exceed 6 inches.
         5) Length as required by close-off pressure, not to exceed 48 inches.
      c. Seals:
         1) Blades: Replaceable, mechanically attached extruded silicone, vinyl, or plastic composite.
         2) Jambs: Stainless steel, compression type.
      d. Axles: 0.5-inch- diameter [plated] [or] [stainless] steel, mechanically attached to blades.
      e. Bearings:

1) Stainless steel mounted in frame.
2) Where blade axles are installed in vertical position, provide thrust bearings.

f. Linkage:
1) Concealed in frame.
2) Constructed of aluminum and [plated] [or] [stainless] steel.
3) Hardware: Stainless steel.

g. Transition:
1) For round and flat oval duct applications, provide damper assembly with integral transitions to mate to adjoining field connection.
2) Factory mount damper in a sleeve with a close transition to mate to field connection.
3) Damper size and sleeve shall be connection size plus 2 inches.
4) Sleeve length shall be not less than 12 inches for dampers without jackshafts and shall be not less than 16 inches for dampers with jackshafts.
5) Sleeve material shall match adjacent duct.

2.3 GENERAL CONTROL-DAMPER ACTUATORS REQUIREMENTS

A. Actuators shall operate related damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which the damper is subjected.

B. Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the fan shutoff pressure as a minimum requirement.

C. The total damper area operated by an actuator shall not exceed 80 percent of manufacturer's maximum area rating.

D. Provide one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison.

E. Avoid the use of excessively oversized actuators which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.

F. Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.

G. Provide mounting hardware and linkages for connecting actuator to damper.

H. Select actuators to fail in desired position in the event of a power failure.

I. Actuator Fail Positions As indicated below:
1. Outdoor Air: Close.

2.4 ELECTRIC AND ELECTRONIC ACTUATORS

A. Type: Motor operated, with or without gears, electric and electronic.

B. Voltage:
1. [See Drawings] [Voltage selection is delegated to professional designing control system] [24 V] [120 V] <Insert requirement>.
2. Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
3. Actuator shall function properly within a range of 85 to 120 percent of nameplate voltage.

C. Construction:
   1. Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
   2. 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.
   3. Greater Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.

D. Field Adjustment:
   1. Spring return actuators shall be easily switchable from fail open to fail closed in the field without replacement.
   2. Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when the actuator is not powered.

E. Two-Position Actuators: Single direction, spring return or reversing type.

F. Position Feedback:
   1. Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
   2. Provide a position indicator and graduated scale on each actuator indicating open and closed travel limits.

G. Fail-Safe:
   1. Where indicated, provide actuator to fail to an end position.
   2. Internal spring return mechanism to drive controlled device to an end position (open or close) on loss of power.
   3. Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.

H. Integral Overload Protection:
   1. Provide against overload throughout the entire operating range in both directions.
   2. Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

I. Damper Attachment:
   1. Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.
   2. Attach actuator to damper drive shaft in a way that ensures maximum transfer of power and torque without slippage.
   3. Bolt and set screw method of attachment is acceptable only if provided with at least two points of attachment.

J. Temperature and Humidity:
   1. Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of [minus 20 to plus 120 deg F] <Insert temperature range>.
   2. Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from [5 to 95] <Insert numbers> percent relative humidity, non-condensing.

K. Enclosure:
   1. Suitable for ambient conditions encountered by application.
   2. NEMA 250, Type 2 for indoor and protected applications.
   3. NEMA 250, Type 4 or Type 4X for outdoor and unprotected applications.

4. Provide actuator enclosure with a heater and controller where required by application.

L. Stroke Time:
1. Operate damper from fully closed to fully open within [15] [60] [75] [90] [150] <Insert number> seconds.
2. Operate damper from fully open to fully closed within [15] [60] [75] [90] [150] <Insert number> seconds.
3. Move damper to failed position within [5] [15] [30] <Insert number> seconds.
4. Select operating speed to be compatible with equipment and system operation.
5. Actuators operating in smoke control systems comply with governing code and NFPA requirements.

M. Sound:
1. Spring Return: 62 dBA.
2. Non-Spring Return: 45 dBA.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for dampers and instruments installed in duct systems to verify actual locations of connections before installation.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CONTROL-DAMPER APPLICATIONS

A. Control Dampers:

B. Select from damper types indicated in "Control Dampers" Article to achieve performance requirements and characteristics indicated while subjected to full range of system operation encountered.
1. Rectangular Outdoor Air Duct Applications with SMACNA Construction Class <Insert value> and Velocities to <Insert value>: [Rectangular dampers with aluminum airfoil blades] [Rectangular dampers with steel airfoil blades] [Industrial-duty rectangular dampers with steel airfoil blades] [Rectangular dampers with aluminum flat blades] [Rectangular dampers with steel flat blades] [Insulated rectangular dampers] [Round dampers, sleeve type] [Round dampers, flange type].

3.3 INSTALLATION, GENERAL

A. Furnish and install products required to satisfy most stringent requirements indicated.

B. Properly support dampers and actuators, tubing, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment when subjected to a <Insert valve> force.

C. Provide ceiling, floor, roof, and wall openings and sleeves required by installation. Before proceeding with drilling, punching, or cutting, check location first for concealed products that

could potentially be damaged. Patch, flash, grout, seal, and refinish openings to match adjacent condition.

D. Seal penetrations made in fire-rated and acoustically rated assemblies.

E. Fastening Hardware:
1. Stillson wrenches, pliers, or other tools that will cause injury to or mar surfaces of rods, nuts, and other parts are prohibited for assembling and tightening nuts.
2. Tighten bolts and nuts firmly and uniformly. Do not overstress threads by excessive force or by oversized wrenches.
3. Lubricate threads of bolts, nuts, and screws with graphite and oil before assembly.

F. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.4 ELECTRIC POWER

A. Furnish and install electrical power to products requiring electrical connections.

3.5 CONTROL DAMPERS

A. Install smooth transitions, not exceeding [15] [30] <Insert number> degrees, to dampers smaller than adjacent duct. Install transitions as close to damper as possible but at distance to avoid interference and impact to performance. Consult manufacturer for recommended clearance.

B. Clearance:
1. Locate dampers for easy access and provide separate support of dampers that cannot be handled by service personnel without hoisting mechanism.
2. Install dampers with at least 24 inches of clear space on sides of dampers requiring service access.

C. Service Access:
1. Dampers and actuators shall be accessible for visual inspection and service.
2. Install access door(s) in duct or equipment located upstream of damper to allow service personnel to hand clean any portion of damper, linkage, and actuator. Comply with requirements in Section 23 33 00 "Air Duct Accessories."

D. Install dampers straight and true, level in all planes, and square in all dimensions. Install supplementary structural steel reinforcement for large multiple-section dampers if factory support alone cannot handle loading.

E. Attach actuator(s) to damper drive shaft.

F. For duct-mounted and equipment-mounted dampers installed outside of equipment, install a visible and accessible indication of damper position from outside.

3.6 CONNECTIONS

A. Connect electrical devices and components to electrical grounding system. Comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.7 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Each piece of wire, cable, and tubing shall have the same designation at each end for operators to determine continuity at points of connection. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Install engraved phenolic nameplate with damper identification on damper[and on face of ceiling where damper is concealed above ceiling].

3.8 CHECKOUT PROCEDURES

A. Control-Damper Checkout:
   1. Check installed products before continuity tests, leak tests, and calibration.
   2. Check dampers for proper location and accessibility.
   3. Check instrument tubing for proper isolation, fittings, slope, dirt legs, drains, material, and support.
   4. Verify that control dampers are installed correctly for flow direction.
   5. Verify that proper blade alignment, either parallel or opposed, has been provided.
   6. Verify that damper frame attachment is properly secured and sealed.
   7. Verify that damper actuator and linkage attachment are secure.
   8. Verify that actuator wiring is complete, enclosed, and connected to correct power source.
   9. Verify that damper blade travel is unobstructed.

3.9 ADJUSTMENT, CALIBRATION, AND TESTING:

A. Stroke and adjust control dampers following manufacturer's recommended procedure, from 100 percent open to 100 percent closed back to 100 percent open.

B. Stroke control dampers with pilot positioners. Adjust damper and positioner following manufacturer's recommended procedure, so damper is 100 percent closed, 50 percent closed, and 100 percent open at proper air pressure.

C. Check and document open and close cycle times for applications with a cycle time of less than 30 seconds.

D. For control dampers equipped with positive position indication, check feedback signal at multiple positions to confirm proper position indication.

END OF SECTION 23 09 23.12

SECTION 23 11 23 - FACILITY NATURAL-GAS PIPING

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. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Pressure regulators.

1.3 DEFINITIONS

A. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following:
1. Piping specialties.
2. Corrugated, stainless-steel tubing with associated components.
3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
4. Pressure regulators. Indicate pressure ratings and capacities.
5. Dielectric fittings.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.

B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.7 PROJECT CONDITIONS

A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.

1.8 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Section 08 31 13 "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:
   1. Piping and Valves: 100 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less .

2.2 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
   2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
   3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
   4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
      a. Material Group: 1.1.
      b. End Connections: Threaded or butt welding to match pipe.
      c. Lapped Face: Not permitted underground.
      d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
      e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
   5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.
      a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. PE Pipe: ASTM D 2513, SDR 11.
   1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
   2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
   3. Transition Service-Line Risers: Factory fabricated and leak tested.

a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
b. Outlet shall be threaded or flanged or suitable for welded connection.
c. Bridging sleeve over mechanical coupling.
d. Factory-connected anode.
e. Tracer wire connection.
f. Ultraviolet shield.
g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Plastic Mechanical Couplings, NPS 1-1/2 and Smaller: Capable of joining PE pipe to PE pipe.
   a. PE body with molded-in, stainless-steel support ring.
   b. Buna-nitrile seals.
   c. Acetal collets.
   d. Electro-zinc-plated steel stiffener.
5. Plastic Mechanical Couplings, NPS 2 and Larger: Capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Fiber-reinforced plastic body.
   b. PE body tube.
   c. Buna-nitrile seals.
   d. Acetal collets.
   e. Stainless-steel bolts, nuts, and washers.
6. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
   a. Stainless-steel flanges and tube with epoxy finish.
   b. Buna-nitrile seals.
   c. Stainless-steel bolts, washers, and nuts.
   d. Factory-installed anode for steel-body couplings installed underground.

2.3 PIPING SPECIALTIES

A. Appliance Flexible Connectors:
   1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
   2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
   3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
   4. Corrugated stainless-steel tubing with polymer coating.
   5. Operating-Pressure Rating: 0.5 psig.
   6. End Fittings: Zinc-coated steel.
   7. Threaded Ends: Comply with ASME B1.20.1.
   8. Maximum Length: 72 inches

2.4 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.5 PRESSURE REGULATORS

A. General Requirements:
   1. Single stage and suitable for natural gas.

2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.

B. Appliance Pressure Regulators: Comply with ANSI Z21.18.
1. Body and Diaphragm Case: Die-cast aluminum.
2. Springs: Zinc-plated steel; interchangeable.
3. Diaphragm Plate: Zinc-plated steel.
4. Seat Disc: Nitrile rubber.
5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
8. Maximum Inlet Pressure: 2 psig .

2.6 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Close equipment shutoff valves before turning off natural gas to premises or piping section.

B. Inspect natural-gas piping according to the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.

C. Comply with the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 31 20 00 "Earth Moving" for excavating, trenching, and backfilling.
1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:
1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.

2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Install fittings for changes in direction and branch connections.

F. Install pressure gage upstream and downstream from each service regulator. Pressure gages are specified in Section 23 05 19 "Meters and Gages for HVAC Piping."

3.4 INDOOR PIPING INSTALLATION

A. Comply with the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

3.5 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:
1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:
1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 23 05 29 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for steel piping , with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Install hangers for corrugated stainless-steel tubing, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

E. Support horizontal piping within 12 inches of each fitting.

F. Support vertical runs of steel piping to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

G. Support vertical runs of corrugated stainless-steel tubing to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.8 LABELING AND IDENTIFYING

A. Comply with requirements in Section 23 05 53 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.9 PAINTING

A. Comply with requirements in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for painting interior and exterior natural-gas piping.

B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.

C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
   1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
      a. Prime Coat: Alkyd anticorrosive metal primer.
      b. Intermediate Coat: Interior latex matching topcoat.
      c. Topcoat: Interior latex (gloss).
      d. Color: Yellow .

D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

3.10 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Test, inspect, and purge natural gas according to the International Fuel Gas Code and authorities having jurisdiction.

C. Natural-gas piping will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.12 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:
   1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
   2. Steel pipe with wrought-steel fittings and welded joints, or mechanical couplings. Coat pipe and fittings with protective coating for steel piping.

B. Aboveground natural-gas piping shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

3.13 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

A. Aboveground, branch piping NPS 2 and smaller shall be the following:
   1. Steel pipe with malleable-iron fittings and threaded joints.

END OF SECTION 23 11 23

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.

1.2 SUMMARY

A. Section Includes:
   1. Single-wall rectangular ducts and fittings.
   2. Sheet metal materials.
   3. Hangers and supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.

1.4 QUALITY ASSURANCE

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
   1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

2.4 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
   2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
   3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
   1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   2. Conditioned Space, Exhaust Ducts: Seal Class B.
   3. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

END OF SECTION 23 31 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. Section Includes:
   1. Centrifugal ventilators - roof downblast.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes for fans.
   2. Rated capacities, operating characteristics, and furnished specialties and accessories.
   3. Certified fan performance curves with system operating conditions indicated.
   4. Certified fan sound-power ratings.
   5. Motor ratings and electrical characteristics, plus motor and electrical accessories.
   6. Material thickness and finishes, including color charts.
   7. Dampers, including housings, linkages, and operators.
   8. Prefabricated roof curbs.
   9. Fan speed controllers.

1.4 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of unit components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.2 CENTRIFUGAL VENTILATORS - ROOF DOWNBLAST

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Acme Engineering & Manufacturing Corp.
   2. Greenheck Fan Corporation.
   3. Loren Cook Company.

B. Housing: Downblast; removable spun-aluminum dome top and outlet baffle ; square, one-piece aluminum base with venturi inlet cone.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades Type A .

D. Accessories:
   1. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
   2. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

E. Prefabricated Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
   1. Configuration: Manufactured to accommodate roof slope.
   2. Overall Height: 12 inches .

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 05 13 "Common Motor Requirements for HVAC Equipment."
   1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.4 SOURCE QUALITY CONTROL

A. AMCA Certification for Fan Sound Performance Rating: Test, rate, and label in accordance with AMCA 311.

B. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install power ventilators level and plumb.

B. Equipment Mounting:
   1. Secure roof-mounted fans to roof curbs with zinc-plated hardware. See Section 07 72 00 "Roof Accessories" for installation of roof curbs.
   2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 23 05 48 "Vibration and Seismic Controls for HVAC."

C. Install units with clearances for service and maintenance.

D. Label units according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

3.2 DUCTWORK CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 23 33 00 "Air Duct Accessories."

3.3 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
   2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.5 STARTUP SERVICE:

A. Perform startup service.
   1. Complete installation and startup checks in accordance with manufacturer's written instructions.
   2. Verify that shipping, blocking, and bracing are removed.
   3. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   4. Verify that cleaning and adjusting are complete.
   5. For direct-drive fans, verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
   6. For belt-drive fans, disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   7. Adjust belt tension.
   8. Adjust damper linkages for proper damper operation.
   9. Verify lubrication for bearings and other moving parts.
   10. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   11. Disable automatic temperature-control operators, energize motor and confirm proper motor rotation and unit operation, adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   12. Shut unit down and reconnect automatic temperature-control operators.
   13. Remove and replace malfunctioning units and retest as specified above.

3.6 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

D. Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.7 CLEANING

A. After completing system installation and testing, adjusting, and balancing and after completing startup service, clean fans internally to remove foreign material and construction dirt and dust.

3.8 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain centrifugal fans.

END OF SECTION 23 34 23

SECTION 23 55 33.16 - GAS-FIRED UNIT HEATERS

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 gas-fired unit heaters.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of gas-fired unit heater.
   1. Include rated capacities, operating characteristics, and accessories.

1.4 QUALITY ASSURANCE

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace heat exchanger of gas-fired unit heater that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Modine Manufacturing Company.
   2. REZNOR, a brand of Nortek Global HVAC.
   3. Sterling HVAC Products; a Mestek company.
   4. Trane.

2.2 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 MANUFACTURED UNITS

A. Description: Factory assembled, piped, and wired, and complying with ANSI Z83.8/CSA 2.6.

B. Gas Type: Design burner for natural propane gas having characteristics same as those of gas available at Project site.

C. Type of Venting: Indoor, separated combustion, power vented.

D. Housing: Steel, with integral draft hood and inserts for suspension mounting rods.
   1. External Casings and Cabinets: Baked enamel over corrosion-resistant-treated surface.

E. Accessories:
   1. Four-point suspension kit.

F. Heat Exchanger: Stainless steel.

G. Burner Material: Stainless steel.

H. Propeller Unit Fan:
   1. Aluminum propeller blades riveted to heavy-gage steel spider bolted to cast-iron hub, dynamically balanced, and resiliently mounted.
   2. Fan-Blade Guard: Galvanized steel, complying with OSHA specifications, removable for maintenance.

I. Controls: Regulated redundant gas valve containing pilot solenoid valve, electric gas valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff all in one body.
   1. Gas Control Valve: Single stage .
   2. Ignition: Electronically controlled electric spark with flame sensor.
   3. Fan Thermal Switch: Operates fan on heat-exchanger temperature.
   4. Vent Flow Verification: Differential pressure switch to verify open vent.
   5. Control transformer.
   6. High Limit: Thermal switch or fuse to stop burner.
   7. Wall -Mounted Thermostat:
      a. Single stage.
      b. Fan on-off-automatic switch.
      c. 24-V ac.
      d. 50 to 90 deg F operating range.

J. Electrical Connection: Factory wire motors and controls for a single electrical connection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install and connect gas-fired unit heaters and associated gas and vent features and systems according to NFPA 54 , applicable local codes and regulations, and manufacturer's written instructions.

3.2 EQUIPMENT MOUNTING

A. Suspended Units: Suspend from substrate using threaded rods, spring hangers, and building attachments. Secure rods to unit hanger attachments. Adjust hangers so unit is level and plumb.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to gas-fired unit heater, allow space for service and maintenance.

C. Gas Piping: Comply with Section 23 11 23 "Facility Natural-Gas Piping." Connect gas piping to gas train inlet; provide union with enough clearance for burner removal and service.

D. Vent Connections: Comply with Section 23 51 23 "Gas Vents."

E. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

F. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Adjust burner and other unit components for optimum heating performance and efficiency.

END OF SECTION 23 55 33.16

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copper building wire.
2. Aluminum building wire.
3. Fire-alarm wire and cable.
4. Connectors and splices.

B. Related Requirements:
1. Section 26 05 23 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: Indicate type, use, and location.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Alpha Wire Company.
2. Belden Inc.
3. General Cable Technologies Corporation.
4. Okonite Company (The).
5. Southwire Company.

C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:
1. Type THWN-2: Comply with UL 83.
2. Type XHHW-2: Comply with UL 44.

F. Shield:

1. Type TC-ER: Cable designed for use with ASDs, with oversized crosslinked polyethylene insulation, dual spirally wrapped copper tape shields and three bare symmetrically applied ground wires, and sunlight- and oil-resistant outer PVC jacket.

2.2 ALUMINUM BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. <Click here to find, evaluate, and insert list of manufacturers and products.>

C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Aluminum, complying with ASTM B800 and ASTM B801.

E. Conductor Insulation:
1. Type XHHW-2: Comply with UL 44.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M Electrical Products.
2. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
3. ILSCO.

C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper, tin plated .
2. Type: Two hole with long barrels.
3. Termination: Compression .

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:
1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
a. Aluminum feeder conductor shall be allowed from the generator to the remote ATS as indicated on the plans.

B. Branch Circuits:
1. Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway Type USE, single conductor in raceway .

B. Exposed Feeders: Type XHHW-2, single conductors in raceway .

C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type XHHW-2, single conductor in raceway. .

D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway .

E. Exposed Branch Circuits, Including in Crawlspaces: Type THHN/THWN-2, single conductors in raceway .

F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway .

G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type XHHW-2, single conductors in raceway .

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.

C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.7 FIRESTOPPING

A. Apply firestopping to all electrical penetrations to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

END OF SECTION 26 05 19

SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Control cable.
   2. Control-circuit conductors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
   1. Flame Travel Distance: 60 inch or less.
   2. Peak Optical Smoke Density: 0.5 or less.
   3. Average Optical Smoke Density: 0.15 or less.

2.2 CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.
   1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket. White for instrumentation.
   5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.
   1. One pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
   2. PVC insulation.
   3. Unshielded.
   4. PVC jacket. White for instrumentation.
   5. Flame Resistance: Comply with NFPA 262.

2.3 CONTROL-CIRCUIT CONDUCTORS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Encore Wire Corporation.
   2. Service Wire Co.
   3. Southwire Company.

B. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway .

C. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway .

D. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Test cables on receipt at Project site.
   1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

A. Comply with requirements in Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
   1. Outlet boxes must be no smaller than 2 inch wide, 3 inch high, and 2-1/2 inch deep.
   2. Outlet boxes for cables must be no smaller than 4 inch square by 2-1/8 inch deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
   3. Flexible metal conduit must not be used.

B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

C. Install manufactured conduit sweeps and long-radius elbows if possible.

D. Raceway Installation in Equipment Rooms:
   1. Position conduit ends adjacent to a corner on backboard if a single piece of plywood is installed, or in the corner of the room if multiple sheets of plywood are installed around perimeter walls of the room.
   2. Install cable trays to route cables if conduits cannot be located in these positions.
   3. Secure conduits to backboard if entering the room from overhead.
   4. Extend conduits 3 inch above finished floor.
   5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

E. Backboards: Install backboards with 96 inch dimension vertical. Butt adjacent sheets tightly and form smooth gap-free corners and joints.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Comply with NECA 1.

B. General Requirements for Cabling:
   1. Comply with TIA-568-C Series of standards.
   2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
   3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.

4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inch and not more than 6 inch from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire must be copper, and grounding methods must comply with IEEE C2. Demonstrate ground resistance.

C. Balanced Twisted Pair Cable Installation:
1. Comply with TIA-568-C.2.
2. Do not untwist balanced twisted pair cables more than 1/2 inch at the point of termination to maintain cable geometry.

D. Installation of Control-Circuit Conductors:
1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

E. Open-Cable Installation:
1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inch above ceilings by cable supports not more than 30 inch apart.
3. Cable must not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Installation of Cable Routed Exposed under Raised Floors:
1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inch of cable in a coil not less than 12 inch in diameter.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded copper voice and data communications cable from potential EMI sources including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment must be as follows:
    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 5 inch.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 12 inch.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 24 inch.
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment must be as follows:
    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: A minimum of 2-1/2 inch.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 6 inch.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 12 inch.
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures must be as follows:
    a. Electrical Equipment or Circuit Rating Less Than 2 kVA: No requirement.
    b. Electrical Equipment or Circuit Rating between 2 and 5 kVA: A minimum of 3 inch.
    c. Electrical Equipment or Circuit Rating More Than 5 kVA: A minimum of 6 inch.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 5 HP and Larger: A minimum of 48 inch.
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inch.

3.4 REMOVAL OF CONDUCTORS AND CABLES

A. Remove abandoned conductors and cables. Abandoned conductors and cables are those installed that are not terminated at equipment and are not identified with a tag for future use.

3.5 CONTROL-CIRCUIT CONDUCTORS

A. Minimum Conductor Sizes:
    1. Class 1 remote-control and signal circuits; No 14 AWG .
    2. Class 2 low-energy, remote-control, and signal circuits; No. 16 AWG .
    3. Class 3 low-energy, remote-control, alarm, and signal circuits; No. 16 AWG. .

3.6 FIRESTOPPING

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.7 GROUNDING

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For control-voltage wiring and cabling, comply with requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.8 IDENTIFICATION

A. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.

C. Identify each wire on each end and at each terminal with a number-coded identification tag. Each wire must have a unique tag.

END OF SECTION 26 05 23

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section includes grounding and bonding systems and equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
   2. Burndy; Hubbell Incorporated, Construction and Energy.
   3. ILSCO.

2.3 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

B. Bare Copper Conductors:
   1. Solid Conductors: ASTM B 3.
   2. Stranded Conductors: ASTM B 8.

C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, with 9/32-inch holes spaced 1-1/8 inches apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

C. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.

D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.

E. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.

G. Conduit Hubs: Mechanical type, terminal with threaded hub.

H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt .

I. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

J. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.

K. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.

L. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.

M. Straps: Solid copper, cast-bronze clamp . Rated for 600 A.

N. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.

O. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.

P. Water Pipe Clamps:
   1. Mechanical type, two pieces with stainless-steel bolts.
      a. Material: Tin-plated aluminum .
      b. Listed for direct burial.
   2. U-bolt type with malleable-iron clamp and copper ground connector rated for direct burial.

2.5 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel ; 5/8 by 96 inches .

B. Ground Plates: 1/4 inch thick, hot-dip galvanized.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

B. Underground Grounding Conductors: Install bare copper conductor, No. 2/0 AWG minimum.
   1. Bury at least 30 inches below grade.

2. Duct-Bank Grounding Conductor: Bury 12 inches above duct bank when indicated as part of duct-bank installation.

C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.

D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.

E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
1. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

F. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

A. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 GROUNDING SEPARATELY DERIVED SYSTEMS

A. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

3.4 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, nonshrink grout.

3.5 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

C. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

D. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.

E. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor per detail on plan sheet in addition to grounding conductor installed with branch-circuit conductors.

3.6 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
   1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
   2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.

D. Grounding and Bonding for Piping:
   1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
   2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
   3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

E. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.
   1. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.
   2. Bond grounding conductor to reinforcing steel in at least two locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

H. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
   1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
   2. Make connections with clean, bare metal at points of contact.
   3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.7 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
   2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type EMT-A and Type EMT-SS raceways and elbows.
2. Type EMT-S raceways and elbows.
3. Type EPEC raceways and fittings.
4. Type ERMC-A and Type ERMC-SS raceways, elbows, couplings, and nipples.
5. Type ERMC-S raceways, elbows, couplings, and nipples.
6. Type LFMC raceways.
7. Type PVC raceways and fittings.
8. Fittings for conduit, tubing, and cable.
9. Surface metal raceways and fittings.
10. Metallic outlet boxes, device boxes, rings, and covers.
11. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.

B. Related Requirements:
1. Section 26 05 19 "Low-Voltage for Electrical Power Conductors and Cables" for nonmetallic underground conduit with conductors (Type NUCC).
2. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.
3. Section 27 05 28 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Raceways and fittings
2. Wireways and auxiliary gutters.
3. Surface raceways.
4. Floor boxes.
5. Cabinets, cutout boxes, and miscellaneous enclosures.

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Steel Electrical Metal Tubing (EMT-S) and Elbows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Atkore International (Allied Tube & Conduit).
b. Atkore International (Calconduit).
c. Emerson Electric Co.
d. Nucor Corporation (Nucor Tubular Products - Republic).
e. Topaz Lighting & Electric.
f. Zekelman Industries (Wheatland Tube).
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

b. General Characteristics:
1) Reference Standards: UL 797 and UL Category Control Number FJMX.
2) Material: Steel.
3) Exterior Coating: Zinc .
4) Interior Coating: Zinc with organic top coating .
c. Options:
1) Minimum Trade Size: 3/4 inch.
2) Colors: As indicated on Drawings.

2.2 TYPE EPEC RACEWAYS AND FITTINGS

A. Schedule 80 Electrical HDPE Underground Conduit (EPEC-80):
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Blue Diamond Industries.
b. J-M Manufacturing Co., Inc. (JM Eagle).
c. Southwire Company.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 651A and UL Category Control Number EAZX.
2) Dimensional Specifications: Schedule 80.
c. Options:
1) Minimum Trade Size: 3/4 inch.

2.3 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

A. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S-G), Elbows, Couplings, and Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Atkore International (Allied Tube & Conduit).
b. Atkore International (Calconduit).
c. Eaton (Crouse-Hinds).
d. Killark; Hubbell Incorporated, Construction and Energy.
e. Nucor Corporation (Nucor Tubular Products - Republic).
f. Zekelman Industries (Wheatland Tube).
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 6 and UL Category Control Number DYIX.
2) Exterior Coating: Zinc.
3) Interior Coating: Zinc with organic top coating .
c. Options:
1) Minimum Trade Size: 3/4 inch.
2) Colors: As indicated on Drawings.

B. PVC-Coated-Steel Electrical Rigid Metal Conduit (ERMC-S-PVC), Elbows, Couplings, and Nipples:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Atkore International (Calbond).
b. Bluesteel Services LLC.

c. Robroy Industries (Perma-Cote).

2. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 6 and UL Category Control Number DYIX.
      2) Exterior Coating: PVC complying with NEMA RN 1 and marked ETL Verified PVC-001.
      3) Interior Coating: Zinc with organic top coating .
      4) Fittings for PVC-Coated Conduit:
         a) Minimum coating thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.
         b) Conduit bodies must be Form 8 with an effective seal and a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 in. of mercury (vacuum) for 72 hours must be available. Conduit bodies must be supplied with plastic-encapsulated stainless steel cover screws.
         c) Form 2 inch long or one pipe diameter long, whichever is less, PVC sleeve at openings of female fittings, except unions. Inside sleeve diameter must be matched to outside diameter of metal conduit.
         d) PVC coating on the outside of conduit couplings must be protected from tool damage during installation.
         e) Female threads on fittings and couplings must be protected by urethane coating.
         f) Fittings must be from same manufacturer as conduit.
         g) Beam clamps and U bolts must be formed and sized to fit outside diameter of coated conduit. Plastic-encapsulated nuts must cover the exposed portions of threads.
   c. Options:
      1) Minimum Trade Size: 3/4 inch.
      2) Colors: As indicated on Drawings.
      3) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
      4) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.4 TYPE LFMC RACEWAYS

A. Steel Liquidtight Flexible Metal Conduit (LFMC-S):
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. ABB (Electrification Products Division).
      b. Anamet Electrical, Inc (Anaconda Sealtite).
      c. Electri-Flex Company.
   2. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standard: UL 360 and UL Category Control Number DXHR.
         2) Material: Steel.
      c. Options:
         1) Minimum Trade Size: 1/2 inch .
         2) Colors: As indicated on Drawings.

2.5 TYPE PVC RACEWAYS AND FITTINGS

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Atkore International (Calconduit).
      b. J-M Manufacturing Co., Inc. (JM Eagle).
      c. Topaz Lighting & Electric.
   2. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standards: UL 651 and UL Category Control Number DZYR.
         2) Dimensional Specifications: Schedule 40.
      c. Options:
         1) Minimum Trade Size: 3/4 inch.
         2) Markings: For use with maximum 90 deg C wire.and

2.6 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Fittings for Type ERMC, Type IMC, Type PVC, Type EPEC, and Type RTRC Raceways:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Appleton - EGS; Emerson Electric Co., Automation Solutions.
      b. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
      c. Atkore International (Konkore Fittings).
      d. Eaton (Crouse-Hinds).
   2. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standards: UL 514B and UL Category Control Number DWTT.
         2) Material: Iron Alloy.
         3) Coupling Method: Compression couplingorRaintight compression coupling with distinctive color gland nutas appropriate.
      c. Options:
         1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
         2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

B. Fittings for Type EMT Raceways:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Appleton - EGS; Emerson Electric Co., Automation Solutions.
      b. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
      c. Atkore International (Allied Tube & Conduit).
      d. Atkore International (Calconduit).
      e. Eaton (Crouse-Hinds).
      f. Southwire Company.
   2. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standards: UL 514B and UL Category Control Number FKAV.

2) Material: Steel .
3) Coupling Method: Compression coupling Raintight compression coupling with distinctive color gland nut Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.

c. Options:
1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
2) Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

C. Fittings for Type LFMC and Type LFNC Raceways:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Liquid Tight Connector Co.
2. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 514B and UL Category Control Number DXAS.

2.7 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Metallic Outlet Boxes:
1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Appleton - EGS; Emerson Electric Co., Automation Solutions.
b. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
c. Eaton (Crouse-Hinds).
d. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
e. Killark; Hubbell Incorporated, Construction and Energy.
f. Pass & Seymour; Legrand North America, LLC.
g. Wiremold; Legrand North America, LLC.
h. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL 514A and UL Category Control Number QCIT.
c. Options:
1) Material: Sheet steelor Cast metal.
2) Sheet Metal Depth: Minimum 2.5 inch .
3) Cast-Metal Depth: Minimum 2.4 inch.
4) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb .
5) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

B. Metallic Conduit Bodies:
1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.

2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Appleton - EGS; Emerson Electric Co., Automation Solutions.
   b. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
   c. Eaton (Crouse-Hinds).
   d. Killark; Hubbell Incorporated, Construction and Energy.
   e. Pass & Seymour; Legrand North America, LLC.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.

C. Metallic Device Boxes:
1. Description: Box with provisions for mounting wiring device directly to box.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Appleton - EGS; Emerson Electric Co., Automation Solutions.
   b. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
   c. Eaton (Crouse-Hinds).
   d. Hubbell Premise Wiring; Hubbell Incorporated, Commercial and Industrial.
   e. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.
   c. Options:
      1) Material: Sheet steel Cast metal.
      2) Sheet Metal Depth: minimum 2.5 inch .
      3) Cast-Metal Depth: minimum 2.4 inch.
      4) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb .
      5) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

D. Metallic Extension Rings:
1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
   b. Eaton (B-line).
   c. Eaton (Crouse-Hinds).
   d. Pass & Seymour; Legrand North America, LLC.
   e. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
3. Applicable Standards:
   a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
   b. General Characteristics:
      1) Reference Standards: UL 514A and UL Category Control Number QCIT.

2.8 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

A. Indoor Sheet Metal Cabinets:
   1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Eaton (Crouse-Hinds).
      b. Killark; Hubbell Incorporated, Construction and Energy.
      c. Milbank Manufacturing Co.
      d. nVent (Hoffman).
   3. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standards: UL Category Control Number CYIV.
            a) Non-Environmental Characteristics: UL 50.
            b) Environmental Characteristics: UL 50E.

B. Indoor Sheet Metal Junction and Pull Boxes:
   1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
      b. Eaton (B-line).
      c. Milbank Manufacturing Co.
      d. nVent (Hoffman).
      e. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
   3. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standards: UL Category Control Number BGUZ.
            a) Non-Environmental Characteristics: UL 50.
            b) Environmental Characteristics: UL 50E.

C. Outdoor Cast-Metal Junction and Pull Boxes:
   1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
   2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Appleton - EGS; Emerson Electric Co., Automation Solutions.
      b. Appleton - O-Z/Gedney; Emerson Electric Co., Automation Solutions.
      c. Eaton (Crouse-Hinds).
   3. Applicable Standards:
      a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
      b. General Characteristics:
         1) Reference Standards: UL Category Control Number BGUZ.
            a) Non-Environmental Characteristics: UL 50.
            b) Environmental Characteristics: UL 50E.
      c. Options:

1) Degree of Protection: Type 3R .

D. Outdoor Polymeric Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Atkore International (Allied Tube & Conduit).
b. J-M Manufacturing Co., Inc. (JM Eagle).
c. Topaz Lighting & Electric.
d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
3. Applicable Standards:
a. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
b. General Characteristics:
1) Reference Standards: UL Category Control Number BGUZ.
a) Non-Environmental Characteristics: UL 50.
b) Environmental Characteristics: UL 50E.
c. Options:
1) Degree of Protection: Type 4X .

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:
1. Exposed Conduit: ERMC .
2. Concealed Conduit, Aboveground: ERMC .
3. Direct-Buried Conduit: [**EPEC-40**] .
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC .

C. Indoors:
1. Hazardous Classified Locations: ERMC .
2. Exposed, Not Subject to Physical Damage: ERMC EMT .
3. Concealed in Ceilings and Interior Walls and Partitions: ERMC EMT .
4. Damp or Wet Locations: ERMC .
5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC .

D. Stub-ups to Above Recessed Ceilings: Provide EMT, IMC, or ERMC for raceways.

E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC and IMC: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:
   1. Outdoors:
      a. Type 3R unless otherwise indicated.
      b. Locations Exposed to Hosedown: Type 6P.
      c. Locations Subject to Potential Flooding: Type 6P.
      d. Locations Aboveground Where Mechanism Must Operate When Ice Covered: Type 3S.
      e. Locations in-Ground or Exposed to Corrosive Agents: Type 4X .
      f. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
   2. Indoors:
      a. Type 1 unless otherwise indicated.
      b. Damp or Dusty Locations: Type 12 .
      c. Surface Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12.
      d. Flush Mounted in Kitchens and Other Locations Exposed to Oil or Coolants: Type 12K.
      e. Locations Exposed to Airborne Dust, Lint, Fibers, or Flyings: Type 4 .
      f. Locations Exposed to Hosedown: Type 6P.
      g. Locations Exposed to Brief Submersion: Type 6 .
      h. Locations Exposed to Prolonged Submersion: Type 6P.
      i. Locations Exposed to Corrosive Agents: Type 4X .
      j. Locations Exposed to Spraying Oil or Coolants: Type 13.

C. Exposed Boxes Installed Less Than 6.5 ft. Above Floor:
   1. Provide cast-metal boxes.
   2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:
   1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.
   2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
   3. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
   4. Comply with NECA NEIS 101 for installation of steel raceways.
   5. Comply with NECA NEIS 102 for installation of aluminum raceways.
   6. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
   7. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
   8. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4 inch trade size and insulated throat metal bushings on 1-1/2 inch trade size and larger conduits terminated with locknuts..
   9. Raceway Terminations at Locations Subject to Moisture or Vibration:
      a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG..

B. General Requirements for Installation of Raceways:
   1. Complete raceway installation before starting conductor installation.

2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft. above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inch of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inch of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Conduit extending from interior to exterior of building.
    d. Conduit extending into pressurized duct and equipment.
    e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    f. Where otherwise required by NFPA 70.
9. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
10. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
11. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
12. Cut conduit perpendicular to the length. For conduits 2 inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Requirements for Installation of Specific Raceway Types:
1. Types ERMC and IMC:
    a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
2. Type ERMC-S-PVC:
    a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
    b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC raceway.

c. Coat field-cut threads on PVC-coated raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

3. Types FMC, LFMC, and LFNC:
   a. Comply with NEMA RV 3. Provide a maximum of 36 inch of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
4. Types PVC and EPEC:
   a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F . Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
   b. Comply with manufacturer's written instructions for solvent welding and fittings.

D. Raceways Embedded in Slabs:
1. Run raceways larger than 1 inch trade size below concrete slab. .
2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
3. Arrange raceways to ensure that each is surrounded by a minimum of 1 inch of concrete without voids.
4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.

E. Stub-ups to Above Recessed Ceilings:
1. Provide EMT, IMC, or ERMC for raceways.
2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
2. EMT: Provide setscrew compression , fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

G. Expansion-Joint Fittings:
1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft.. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft..
2. Install expansion fittings at locations where conduits cross building or structure expansion joints.
3. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.

H. Raceways Penetrating Rooms or Walls with Acoustical Requirements:
1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
   1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
   2. Provide gaskets for wallplates and covers.

3.5 FIRESTOPPING

A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

3.6 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.7 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 26 05 33

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. Section Includes:
   1. Labels.
   2. Tapes and stencils.
   3. Tags.
   4. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

2.2 LABELS

A. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Panduit Corp.
      c. Seton Identification Products; a Brady Corporation company.
   2. Minimum Nominal Size:
      a. 1-1/2 by 6 inches for raceway and conductors.
      b. 3-1/2 by 5 inches for equipment.
      c. As required by authorities having jurisdiction.

2.3 TAPES AND STENCILS

A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Carlton Industries, LP.

B. Underground-Line Warning Tape:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Ideal Industries, Inc.
      c. Seton Identification Products; a Brady Corporation company.
   2. Tape:
      a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
      b. Printing on tape shall be permanent and shall not be damaged by burial operations.
      c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
   3. Color and Printing:
      a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
      b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE" .
      c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE" .
   4. Tape Type I :
      a. Width: 3 inches.
      b. Thickness: 4 mils.
      c. Weight: 18.5 lb/1000 sq. ft..
      d. Tensile according to ASTM D882: 30 lbf and 2500 psi.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch .

2.4 TAGS

A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Panduit Corp.
      c. Seton Identification Products; a Brady Corporation company.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
   1. "EMERGENCY POWER."
   2. "POWER."
   3. "UPS."

L. Self-Adhesive Labels:
   1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

M. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
   1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

N. Nonmetallic Preprinted Tags:
   1. Place in a location with high visibility and accessibility.
   2. Secure using cable ties.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than A and 120 V to Ground: Identify with self-adhesive raceway labels vinyl tape applied in bands.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify the phase.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

F. Operating Instruction Signs: .

END OF SECTION 26 05 53

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. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
   2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.

B. Shop Drawings:
   1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
   3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
   1. If manufacturer packaging is removed for inspection, and transformer will be stored after inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.

C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
2. Federal Pacific.
3. Hammond Power Solutions Inc.
4. Schneider Electric USA (Square D).

B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

2.3 GENERAL TRANSFORMER REQUIREMENTS

A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.

B. Comply with NFPA 70.
1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

C. Transformers Rated 15 kVA and Larger:
1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

D. Shipping Restraints: Paint or otherwise color-code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.4 DISTRIBUTION TRANSFORMERS

A. Comply with NFPA 70 , and list and label as complying with UL 1561.

B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
1. One leg per phase.
2. Core volume shall allow efficient transformer operation at 10 percent above the nominal tap voltage.
3. Grounded to enclosure.

C. Coils: Continuous windings without splices except for taps.
1. Coil Material: Aluminum .
2. Internal Coil Connections: Brazed or pressure type.
3. Terminal Connections: Welded .

D. Enclosure: Ventilated .

1. NEMA 250, Type 3R: Core and coil shall be encapsulated within resin compound using a vacuum-pressure impregnation process to seal out moisture and air.
2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
3. Wiring Compartment: Sized for conduit entry and wiring installation.
4. Finish: Comply with NEMA 250.
   a. Finish Color: Gray weather-resistant enamel.

E. Taps for Transformers 3 kVA and Smaller: None .

F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity .

G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity .

H. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.

I. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.

J. Wall Brackets: Manufacturer's standard brackets. Custom fabricated brackets shall be submitted for engineer approval..

2.5 IDENTIFICATION

A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 26 05 53 "Identification for Electrical Systems."

B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 26 05 53 "Identification for Electrical Systems."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.

B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.

C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.

D. Verify that ground connections are in place and requirements in Section 26 05 26 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-mounted transformers level and plumb with wall brackets .
   1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.

B. Construct concrete bases according to Section 03 30 00 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems."
   1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base according to manufacturer's written instructions.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

A. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 ADJUSTING

A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

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. Section Includes:
   1. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.
   3. Load centers.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Include evidence of NRTL listing for series rating of installed devices.
   7. Include evidence of NRTL listing for SPD as installed in panelboard.
   8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   9. Include wiring diagrams for power, signal, and control wiring.

10. Key interlock scheme drawing and sequence of operations.
11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares of each type and amperage for each panelboard.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407 .

1.10 FIELD CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
   b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Engineer no fewer than 14 days in advance of proposed interruption of electric service.
   2. Comply with NFPA 70E.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
   1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Dry and Clean Locations: NEMA 250, Type 12 .
      b. Outdoor Locations: NEMA 250, Type 3R .
      c. Wash-DownAreas: NEMA 250, Type 4X , stainless steel .
      d. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
   2. Height: 84 inches maximum.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
   4. Finishes:
      a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel .

F. Incoming Mains:
   1. Location: Convertible between top and bottom.
   2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:
   1. Material: Tinned Aluminum.

a. Plating shall run entire length of bus.
b. Bus shall be fully rated the entire length.

2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.

H. Conductor Connectors: Suitable for use with conductor material and sizes.
1. Material: Hard-drawn copper, 98 percent conductivity or aluminum meeting ASTM B800.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.

I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: percent.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 22,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

A. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1 .

2.3 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.

4. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker orLugs only as specified on plan sheets.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers .

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers .

G. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 LOAD CENTERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.

4. Square D; Schneider Electric USA.

B. Load Centers: Comply with UL 67.

C. Mains: Circuit breaker or lugs only.

D. Branch Overcurrent Protective Devices: Plug-in circuit breakers, replaceable without disturbing adjacent units.

E. Doors: Concealed hinges secured with flush latch with tumbler lock; keyed alike.

F. Conductor Connectors: Mechanical type for main, neutral, and ground lugs and buses.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers:
   a. To be used for circuit breakers rated 200 amps and smaller
      1) Inverse time-current element for low-level overloads.
      2) Instantaneous magnetic trip element for short circuits.
      3) Adjustable magnetic trip setting for circuit-breaker frame sizes 100 A and larger.
2. Electronic Trip Circuit Breakers:
   a. To be used for mains and feeders rated larger than 200 Amps
      1) RMS sensing.
      2) Field-replaceable rating plug or electronic trip.
      3) Digital display of settings, trip targets, and indicated metering displays.
      4) Multi-button keypad to access programmable functions and monitored data.
      5) Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
      6) Integral test jack for connection to portable test set or laptop computer.
      7) Field-Adjustable Settings:
         a) Instantaneous trip.
         b) Long- and short-time pickup levels.
         c) Long and short time adjustments.
         d) Ground-fault pickup level, time delay, and I squared T response.
3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
4. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
5. Subfeed Circuit Breakers: Vertically mounted.
6. MCCB Features and Accessories:
   a. Standard frame sizes, trip ratings, and number of poles.
   b. Breaker handle indicates tripped status.
   c. UL listed for reverse connection without restrictive line or load ratings.
   d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
   e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.

f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
g. Rating Plugs: Three-pole breakers with ampere ratings greater than 100 amperes shall have interchangeable rating plugs or electronic adjustable trip units.

2.7 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.8 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407 .

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407 .

D. Equipment Mounting:
   1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete."
   2. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

J. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.
   2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

L. Install filler plates in unused spaces.

M. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

N. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

O. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:
   1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
   2. Test continuity of each circuit.

C. Tests and Inspections:
   1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers and low-voltage surge arrestors stated in NETA ATS, Paragraph 7.6 Circuit Breakers and Paragraph 7.19.1 Surge Arrestors, Low-Voltage . Do not perform optional tests. Certify compliance with test parameters.
   2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
   3. Perform the following infrared scan tests and inspections and prepare reports:
      a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
      b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
      c. Instruments and Equipment:
         1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

D. Panelboards will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.6 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Fusible switches.
2. Nonfusible switches.
3. Molded-case circuit breakers (MCCBs).
4. Enclosures.

1.3 DEFINITIONS

A. NC: Normally closed.

B. NO: Normally open.

C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current ratings (interrupting and withstand, as appropriate).
4. Include evidence of a nationally recognized testing laboratory (NRTL) listing for series rating of installed devices.
5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

B. Shop Drawings: For enclosed switches and circuit breakers.
1. Include plans, elevations, sections, details, and attachments to other work.
2. Include wiring diagrams for power, signal, and control wiring.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Fuse Pullers: Two for each size and type.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
   1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.

B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

D. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB, Electrification Products Division.
   2. Eaton.
   3. Siemens Industry, Inc., Energy Management Division.
   4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty:
   1. Single throw.
   2. Three pole.
   3. 600-V ac.
   4. 1200 A and smaller .
   5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.

6. Lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac .
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

C. Accessories:
1. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
2. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 120-V ac .
3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.4 MOLDED-CASE CIRCUIT BREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.

C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.

D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated .

E. MCCBs shall be equipped with a device for locking in the isolated position.

F. Lugs shall be suitable for 167 deg F rated wire .

G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.

H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 125 A and larger.
   1. Thermal Magnetic to be used for circuit breakers rated 200 Amps and smaller.

I. Electronic Trip Circuit Breakers to be used on circuits rated larger than 200 Amps
   1. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
      a. Instantaneous trip.
      b. Long- and short-time pickup levels.
      c. Long- and short-time time adjustments.
      d. Ground-fault pickup level, time delay, and I-squared t response.

J. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

K. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).

L. Features and Accessories:
   1. Standard frame sizes, trip ratings, and number of poles.
   2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

2.5 ENCLOSURES

A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.

B. Enclosure Finish: The enclosure shall be gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) .

C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.

D. Operating Mechanism: The circuit-breaker operating handle shall be externally operable with the operating mechanism being an integral part of the box, not the cover . The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the

circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.

F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.
   1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

A. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
   1. Notify Architect no fewer than three days in advance of proposed interruption of electric service.
   2. Indicate method of providing temporary electric service.
   3. Do not proceed with interruption of electric service without Architect's written permission.
   4. Comply with NFPA 70E.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
   1. Indoor, Dry and Clean Locations: NEMA 250, Type 1 .
   2. Outdoor Locations: NEMA 250, Type 3R .
   3. Wash-Down Areas: NEMA 250, Type 4X , stainless steel .
   4. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4 .
   5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.

3.4 INSTALLATION

A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

C. Comply with mounting and anchoring requirements specified in Section 26 05 48.16 "Seismic Controls for Electrical Systems."

D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

E. Install fuses in fusible devices.

F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges

END OF SECTION 26 28 16

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. Section includes separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.

1.3 DEFINITIONS

A. CE: Conformite Europeene (European Compliance).

B. CPT: Control power transformer.

C. DDC: Direct digital control.

D. EMI: Electromagnetic interference.

E. LED: Light-emitting diode.

F. NC: Normally closed.

G. NO: Normally open.

H. OCPD: Overcurrent protective device.

I. PID: Control action, proportional plus integral plus derivative.

J. RFI: Radio-frequency interference.

K. VFC: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

A. Product Data: For each type and rating of VFC indicated.
   1. Include dimensions and finishes for VFCs.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each VFC indicated.
   1. Include mounting and attachment details.
   2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
   3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:
   1. Required working clearances and required area above and around VFCs.
   2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.
   3. Show support locations, type of support, and weight on each support.
   4. Indicate field measurements.

B. Product Certificates: For each VFC from manufacturer.

C. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.

D. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
      a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
      b. Manufacturer's written instructions for setting field-adjustable overload relays.
      c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
      d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
      e. 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.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
   2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
   3. Indicating Lights: Two of each type and color installed.
   4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
   5. Power Contacts: Furnish one spares for each size and type of magnetic contactor installed.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.9 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following to match existing:
   1. Rockwell Automation, Inc.
      a. Powerflex 753 Series
   2. Schneider Electric USA, Inc.
      a. Altivar Process 600 Series

2.2 SYSTEM DESCRIPTION

A. General Requirements for VFCs:
   1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
   2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and UL 508A .

B. Application: Variable torque pump application. .

C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
   1. VFD shall be an "Open loop vector" style VFD such that it shall be able to maintain 100% torque down to 3 Hz.
   2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
   3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.

D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.

E. Output Rating: Three phase; 10 to 60 Hz, with voltage proportional to frequency throughout voltage range ; maximum voltage equals input voltage.

F. Note "open loop vector" requirements 2.2.1.C.1 above.

G. Unit Operating Requirements:
   1. Input AC Voltage Tolerance: Plus 10 and minus 10 percent of VFC input voltage rating.
   2. Input AC Voltage Unbalance: Not exceeding 5 percent.
   3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
   4. Minimum Efficiency: 97 percent at 60 Hz, full load.
   5. Minimum Displacement Primary-Side Power Factor: 97 percent under any load or speed condition.
   6. Minimum Short-Circuit Current (Withstand) Rating: 22 kA.

7. Ambient Temperature Rating: Not less than 32 deg F and not exceeding 104 deg F.
8. Humidity Rating: Less than 95 percent (noncondensing).
9. Altitude Rating: Not exceeding 3300 feet.
10. Vibration Withstand: Comply with NEMA ICS 61800-2.
11. Overload Capability: 1.5 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
13. Speed Regulation: Plus or minus 5 percent.
14. Output Carrier Frequency: Selectable; 0.5 to 15 kHz.
15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.

H. Inverter Logic: Microprocessor based, isolated from all power circuits.

I. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
1. Signal: Electrical .

J. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
2. Maximum Speed: 80 to 100 percent of maximum rpm.
3. Acceleration: 0.1 to 999.9 seconds.
4. Deceleration: 0.1 to 999.9 seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.
6. Up to 4 internally programmable speed set points based on position (off/on) of digital inputs.

K. Self-Protection and Reliability Features:
1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.
2. Under- and overvoltage trips.
3. Inverter overcurrent trips.
4. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
5. Critical frequency rejection, with three selectable, adjustable deadbands.
6. Instantaneous line-to-line and line-to-ground overcurrent trips.
7. Loss-of-phase protection.
8. Reverse-phase protection.
9. Short-circuit protection.
10. Motor-overtemperature fault.
11. .

L. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.

M. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.

N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.

O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

P. Integral Input Disconnecting Means and OCPD: Nema KS1, nonfusible switch with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
2. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
3. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.

2.3 CONTROLS AND INDICATION

A. Status Lights: Door-mounted LED indicators displaying the following conditions:
1. Power on.
2. Run.
3. Overvoltage.
4. Line fault.
5. Overcurrent.
6. External fault.

B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:
1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last four faults with time and date stamp for each.

D. Indicating Devices: Digital display mounted flush in VFC door and connected to display VFC parameters including, but not limited to:
1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).

E. Control Signal Interfaces:
1. Electric Input Signal Interface:
a. A minimum of two programmable analog inputs: 4- to 20-mA dc .
b. A minimum of six multifunction programmable digital inputs.

2. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:
   a. 4- to 20-mA dc.
   b. Fixed frequencies using digital inputs.
3. Output Signal Interface: A minimum of one programmable analog output signal(s) (4- to 20-mA dc), which can be configured for any of the following:
   a. Output frequency (Hz).
   b. Output current (load).
   c. Motor torque (percent).
   d. Motor speed (rpm).
   e. Set point frequency (Hz).
4. Remote Indication Interface: A minimum of two programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
   a. Motor running.
   b. Fault and warning indication (overtemperature or overcurrent).

F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
   1. Number of Loops: One .

2.4 LINE CONDITIONING AND FILTERING

A. Input Line Conditioning: Manufacturers standard input line reactors.

B. Output Filtering: manufacturer standard output filtering .

C. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for Category C2 .

2.5 OPTIONAL FEATURES

2.6 ENCLOSURES

A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.
   1. Dry and Clean Indoor Locations: Type 12. .
   2. Outdoor Locations: Type 4X .
   3. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
   4. .

2.7 ACCESSORIES

A. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, Type 12 enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

B. Cooling Fan and Exhaust System: For NEMA 250, Type 12 ; UL 508 component recognized: Supply fan, with stainless-steel intake and exhaust grills and filters ; 120 -V ac; obtained from integral CPT .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of the Work.

B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 26 05 29 "Hangers and Supports for Electrical Systems."

B. Floor-Mounting Controllers: Install VFCs on 4-inch nominal thickness concrete base. Comply with requirements for concrete base specified in Section 03 30 00 "Cast-in-Place Concrete."
   1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
   2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
   3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   4. Install anchor bolts to elevations required for proper attachment to supported equipment.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Install fuses in each fusible-switch VFC.

E. Install fuses in control circuits if not factory installed. Comply with requirements in Section 26 28 13 "Fuses."

F. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.

G. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.

H. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

A. Install wiring between VFCs and remote devices. Comply with requirements in Section 26 05 23 "Control-Voltage Electrical Power Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect selector switches and other automatic-control devices where applicable.
   1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
   2. Connect selector switches with control circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

A. Identify VFCs, components, and control wiring. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
   1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
   2. Label each VFC with engraved nameplate.
   3. Label each enclosure-mounted control and pilot device.

B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.
   1. Complete installation and startup checks according to manufacturer's written instructions.

3.6 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set the taps on reduced-voltage autotransformer controllers.

C. Set field-adjustable circuit-breaker trip ranges as specified by engineer.

3.7 PROTECTION

A. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 26 29 23

SECTION 26 32 13.16 - GAS-ENGINE-DRIVEN GENERATOR SETS

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. Engine.
2. Gas fuel system.
3. Control and monitoring.
4. Generator overcurrent and fault protection.
5. Generator, exciter, and voltage regulator.
6. Outdoor generator-set enclosure.
7. Vibration isolation devices.

B. Related Requirements:
1. Section 26 36 00 "Transfer Switches" for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine generators.

1.3 DEFINITIONS

A. EPS: Emergency power supply.

B. EPSS: Emergency power supply system.

C. LP: Liquefied petroleum.

D. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Include thermal damage curve for generator.
3. Include time-current characteristic curves for generator protective device.
4. Include fuel consumption in cubic feet per hour (cubic meters per hour) at 0.8 power factor at 0.5, 0.75 and 1.0 times generator capacity.
5. Include generator efficiency at 0.8 power factor at 0.5, 0.75, and 1.0 times generator capacity.
6. Include air flow requirements for cooling and combustion air in cfm at 0.8 power factor, with air supply temperature of 95 deg F, 80 deg F, 70 deg F, and 50 deg F. Provide drawings showing requirements and limitations for location of air intake and exhausts.
7. Include generator characteristics, including, but not limited to, kilowatt rating, efficiency, reactances, and short-circuit current capability.

B. Shop Drawings:

1. Include plans and elevations for engine generator and other components specified.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Identify fluid drain ports and clearance requirements for proper fluid drain.
4. Design calculations for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
5. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include base weights.
6. Include diagrams for power, signal, and control wiring. Complete schematic, wiring, and interconnection diagrams showing terminal markings for EPS equipment and functional relationship between all electrical components.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For engine generators to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
      a. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.
      b. Operating instructions laminated and mounted adjacent to generator location.
      c. Training plan.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
   2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
   3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
   4. Tools: Each tool listed by part number in operations and maintenance manual.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Accredited by NETA.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Caterpillar
   2. Cummins Power Generation.
   3. Kohler.
   4. Blue Star.

B. Source Limitations: Obtain packaged engine generators and auxiliary components through one source from a single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. B11 Compliance: Comply with B11.19.

B. NFPA Compliance:
1. Comply with NFPA 37.
2. Comply with NFPA 70.
3. Comply with NFPA 99.
4. Comply with NFPA 110 requirements for Level 2 EPSS.

C. UL Compliance: Comply with UL 2200.

D. Environmental Conditions: Engine generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
1. Ambient Temperature: 5 to 104 deg F.
2. Relative Humidity: Zero to 95 percent.
3. Altitude: Sea level to 1000 feet .

2.3 ENGINE GENERATOR ASSEMBLY DESCRIPTION

A. Factory-assembled and -tested, water-cooled engine, with brushless generator and accessories.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and use.

C. Power Rating: Standby.

D. Overload Capacity: 110 percent of service load for 1 hour in 12 consecutive hours.

E. Service Load: See schedule on drawings.

F. Power Factor: 0.8 , lagging.

G. Frequency: 60 Hz.

H. Voltage: 480 V ac.

I. Phase: Three-phase, four wire, wye .

J. Induction Method: Naturally aspirated .

K. Governor: Adjustable isochronous, with speed sensing.

L. Mounting Frame: Structural steel framework to maintain alignment of mounted components without depending on concrete foundation. Provide lifting attachments sized and spaced to prevent deflection of base during lifting and moving.
1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.

M. Capacities and Characteristics:
   1. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.

N. Engine Generator Performance:
   1. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
   2. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within three seconds.
   3. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.
   4. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
   5. Transient Frequency Performance: Less than 3 percent variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within five seconds.
   6. Output Waveform: At no load, harmonic content measured line to line or line to neutral shall not exceed 5 percent total and 3 percent for single harmonics. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
   7. Sustained Short-Circuit Current: For a three-phase, bolted short circuit at system output terminals, system shall supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to generator system components.
   8. Start Time:
      a. Comply with NFPA 110, Type 10 system requirements.

2.4 GAS ENGINE

A. Fuel: Natural gas .

B. Lubrication System: Engine or skid-mounted.
   1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
   2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
   3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.

C. Jacket Coolant Heater: Electric-immersion type, factory installed in coolant jacket system. Comply with UL 499.

D. Integral Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine generator mounting frame and integral engine-driven coolant pump.
   1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
   2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
   3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
   4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.

5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
    a. Rating: 50-psig maximum working pressure with coolant at 180 deg F, and noncollapsible under vacuum.
    b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

E. Muffler/Silencer:
1. Critical type, sized as recommended by engine manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
    a. Minimum sound attenuation of 25 dB at 500 Hz.
    b. Sound level measured at a distance of 25 feet from exhaust discharge after installation is complete shall be 78 dBA or less.

F. Air-Intake Filter: Standard -duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.

G. Starting System: 12 -V electric, with negative ground.
1. Components: Sized so they are not damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Performance Requirements" Article.
2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.
3. Cranking Cycle: As required by NFPA 110 for system level specified .
4. Battery: Lead acid , with capacity within ambient temperature range specified in "Performance Requirements" Article to provide specified cranking cycle at least three times without recharging.
5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 50 deg F regardless of external ambient temperature within range specified in "Performance Requirements" Article. Include accessories required to support and fasten batteries in place. Provide ventilation to exhaust battery gases.
7. Battery Stand: Factory-fabricated, two-tier metal with acid-resistant finish designed to hold the quantity of battery cells required and to maintain the arrangement to minimize lengths of battery interconnections.
8. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35 A minimum continuous rating.
9. Battery Charger: Current-limiting, automatic-equalizing and float-charging type designed for lead-acid batteries. Unit shall comply with UL 1236 and include the following features:
    a. Operation: Equalizing-charging rate of 10 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
    b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg F to 140 deg F to prevent overcharging at high temperatures and undercharging at low temperatures.
    c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
    d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
    e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition

shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.

f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

2.5 GAS FUEL SYSTEM

A. Natural Gas Piping: Comply with requirements in Section 23 11 23 "Facility Natural Gas Piping."

B. Gas Train: Comply with NFPA 37.

C. Engine Fuel System:

D. Natural Gas , Vapor-Withdrawal System:

1. Carburetor.
2. Fuel-Shutoff Solenoid Valves: NRTL-listed, normally closed, safety shutoff valves; one for each fuel source.
3. Fuel Filters: One for each fuel type.
4. Manual Fuel Shutoff Valves: One for each fuel type.
5. Flexible Fuel Connectors: Minimum one for each fuel connection.
6. Fuel change gas pressure switch.

2.6 CONTROL AND MONITORING

A. Automatic Starting System Sequence of Operation: When mode-selector switch on the control and monitoring panel is in the automatic position, remote-control contacts in one or more separate automatic transfer switches initiate starting and stopping of engine generator. When mode-selector switch is switched to the on position, engine generator starts. The off position of same switch initiates generator-set shutdown. When engine generator is running, specified system or equipment failures or derangements automatically shut down engine generator and initiate alarms.

B. Provide minimum run time control set for 15 minutes with override only by operation of a remote emergency-stop switch.

C. Comply with UL 508A.

D. Configuration:

1. Operating and safety indications, protective devices, basic system controls, and engine gages shall be grouped in a common control and monitoring panel mounted on the engine generator. Mounting method shall isolate the control panel from generator-set vibration. Panel shall be powered from the engine generator battery.

E. Control and Monitoring Panel:

1. Digital controller with integrated LCD, controls, and microprocessor, capable of local and remote control, monitoring, and programming, with battery backup.
2. Instruments: Located on the control and monitoring panel and viewable during operation.
   a. Engine lubricating-oil pressure gage.
   b. Engine-coolant temperature gage.
   c. DC voltmeter (alternator battery charging).
   d. Running-time meter.
   e. AC voltmeter, .
   f. AC ammeter, .
   g. AC frequency meter.
3. Controls and Protective Devices: Controls, shutdown devices, and common visual alarm indication, including the following:

a. Cranking control equipment.
b. Run-Off-Auto switch.
c. Control switch not in automatic position alarm.
d. Overcrank alarm.
e. Overcrank shutdown device.
f. Low water temperature alarm.
g. High engine temperature prealarm.
h. High engine temperature.
i. High engine temperature shutdown device.
j. Overspeed alarm.
k. Overspeed shutdown device.
l. Coolant low-level alarm.
m. Coolant low-level shutdown device.
n. Coolant high-temperature prealarm.
o. Coolant high-temperature alarm.
p. Coolant low-temperature alarm.
q. Coolant high-temperature shutdown device.
r. EPS supplying load indicator.
s. Battery high-voltage alarm.
t. Low cranking voltage alarm.
u. Battery-charger malfunction alarm.
v. Battery low-voltage alarm.
w. Lamp test.
x. Contacts for local and remote common alarm.
y. Remote manual stop shutdown device.
z. Hours of operation.
aa. Engine generator metering, including voltage, current, Hz, kW, kVA, and power factor.
bb. Generator overcurrent protective device not closed alarm.

F. Remote Emergency-Stop Switch: Flush; wall mounted, unless otherwise indicated; and labeled. Push button shall be protected from accidental operation.

G. Supporting Items: Include sensors, transducers, terminals, relays, and other devices and include wiring required to support specified items. Locate sensors and other supporting items on engine or generator, unless otherwise indicated.

2.7 GENERATOR OVERCURRENT AND FAULT PROTECTION

A. Generator Overcurrent Protective Device:
1. Molded-case circuit breaker, thermal-magnetic type; 100 percent rated; complying with UL 489:
a. Tripping Characteristic: Designed specifically for generator protection.
b. Trip Rating:
1) Palmer Site: System shall consist of two parallel circuit breakers (as sized on plans) to serve the two automatic transfer switches.
2) Juniper: System shall consist of a singel circuit breaker to serve the proposed automatic transfer switch.
c. Mounting: Adjacent to or integrated with control and monitoring panel.

2.8 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1.

B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor and shall be permanent magnet type.

C. Electrical Insulation: Class H .

D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required. Provide six lead alternator.

E. Range: Provide broad range of output voltage by adjusting the excitation level.

F. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified and as required by NFPA 110.
   1. Digital control: Provide plus or minus 5 percent adjustment of output-voltage operating band.
   2. Maintain voltage within 20 percent on one step, full load.
   3. Provide anti-hunt provision to stabilize voltage.
   4. Maintain frequency within 5 percent and stabilize at rated frequency within 2 seconds.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Subtransient Reactance: [**12**] percent, maximum.

2.9 OUTDOOR GENERATOR-SET ENCLOSURE

A. Description:
   1. Vandal-resistant, sound-attenuating, weatherproof steel housing, wind resistant up to 100 mph. Multiple panels shall be lockable and provide adequate access to components requiring maintenance. Panels shall be removable by one person without tools. Instruments and control shall be mounted within enclosure.
      a. Sound Attenuation Level: 1 .
   2. Prefabricated or pre-engineered galvanized-steel-clad, integral structural-steel-framed, walk-in enclosure, erected on concrete foundation.

B. Structural Design and Anchorage: Comply with ASCE/SEI 7 for wind loads up to 100 mph.

C. Hinged Doors: With padlocking provisions.

D. Muffler Location: Within enclosure.

E. Engine Cooling Airflow through Enclosure: Maintain temperature rise of system components within required limits when unit operates at 110 percent of rated load for 2 hours with ambient temperature at top of range specified in system service conditions.
   1. Louvers: Fixed-engine, cooling-air inlet and discharge. Storm-proof and drainable louvers prevent entry of rain and snow.

2.10 VIBRATION ISOLATION DEVICES

A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
   1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
   2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
   3. Minimum Additional Travel: 50 percent of required deflection at rated load.
   4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   6. Minimum Deflection: 1 inch .

B. Comply with requirements in Section 23 21 16 "Hydronic Piping Specialties" for vibration isolation and flexible connector materials for steel piping.

C. Comply with requirements in Section 23 31 13 "Metal Ducts" for vibration isolation and flexible connector materials for exhaust shroud and ductwork.

D. Vibration isolation devices shall not be used to accommodate misalignments or to make bends.

2.11 FINISHES

A. Indoor and Outdoor Enclosures and Components: Manufacturer's standard finish over corrosion-resistant pretreatment and compatible primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine generator performance.

B. Examine roughing-in for piping systems and electrical connections. Verify actual locations of connections before packaged engine generator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
   1. Notify Owner no fewer than two working days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Owner's written permission.

3.3 INSTALLATION

A. Comply with NECA 1 and NECA 404.

B. Comply with packaged engine generator manufacturers' written installation and alignment instructions and with NFPA 110.

C. Equipment Mounting:
   1. Coordinate size and location of concrete bases for packaged engine generators. Cast anchor-bolt inserts into bases.

D. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.

E. Gaseous Fuel Piping:
   1. Natural gas piping, valves, and specialties for gas distribution are specified in Section 23 11 23 "Facility Natural Gas Piping."

F. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.

3.4 CONNECTIONS

A. Gaseous Fuel Connections:
   1. Connect fuel piping to engines with a gate valve and union and flexible connector.
   2. Install manual shutoff valve in a remote location to isolate gaseous fuel supply to the generator.
   3. Vent gas pressure regulators outside building a minimum of 60 inches from building openings.

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables." Provide a minimum of one 90-degree bend in flexible conduit routed to the engine generator from a stationary element.

3.5 IDENTIFICATION

A. Identify system components according to Section 23 05 53 "Identification for HVAC Piping and Equipment" and Section 26 05 53 "Identification for Electrical Systems."

B. Install a sign indicating the generator neutral is bonded to the main service neutral at the main service location.

3.6 FIELD QUALITY CONTROL

A. Testing Agency:
   1. Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
   1. Perform tests recommended by manufacturer and each visual and mechanical inspection and electrical and mechanical test listed in the first two subparagraphs below as specified in the NETA ATS. Certify compliance with test parameters.
      a. Visual and Mechanical Inspection:
         1) Compare equipment nameplate data with drawings and specifications.
         2) Inspect physical and mechanical condition.
         3) Inspect anchorage, alignment, and grounding.
         4) Verify the unit is clean.
      b. Electrical and Mechanical Tests:
         1) Perform insulation-resistance tests in accordance with IEEE 43.

a) Machines 200 hp or less. Test duration shall be one minute. Calculate the dielectric-absorption ratio.

2) Test protective relay devices.

3) Verify phase rotation, phasing, and synchronized operation as required by the application.

4) Functionally test engine shutdown for low oil pressure, overtemperature, overspeed, and other protection features as applicable.

5) Verify correct functioning of the governor and regulator.

2. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here, including, but not limited to, single-step full-load pickup test.

3. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
   a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
   b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
   c. Verify acceptance of charge for each element of the battery after discharge.
   d. Verify that measurements are within manufacturer's specifications.

4. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

5. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

C. Coordinate tests with tests for transfer switches and run them concurrently.

D. Test instruments shall have been calibrated within the last 12 months, traceable to NIST Calibration Services, and adequate for making positive observation of test results. Make calibration records available for examination on request.

E. Leak Test: After installation, charge exhaust, coolant, and fuel systems and test for leaks. Repair leaks and retest until no leaks exist.

F. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation for generator and associated equipment.

G. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

H. Remove and replace malfunctioning units and retest as specified above.

I. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.

3.7 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, provide 24 months' full maintenance by skilled employees of manufacturer's designated service organization. Include quarterly exercising to check for proper starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for

proper operation including oil changes, and filter changes. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain packaged engine generators.

END OF SECTION 26 32 13.16

SECTION 26 36 00 - TRANSFER SWITCHES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Contactor-type automatic transfer switches.
   2. Transfer switch accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for transfer switches.
   2. Include rated capacities, operating characteristics, electrical characteristics, and accessories.

B. Shop Drawings:
   1. Include plans, elevations, sections, details showing minimum clearances, conductor entry provisions, gutter space, and installed features and devices.
   2. Include material lists for each switch specified.
   3. Single-Line Diagram: Show connections between transfer switch, power sources, and load; and show interlocking provisions for each combined transfer switch and bypass/isolation switch.
   4. Riser Diagram: Show interconnection wiring between transfer switches, bypass/isolation switches, annunciators, and control panels.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals.
   1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
      a. Features and operating sequences, both automatic and manual.
      b. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.5 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service:
   1. Notify Engineer and Owner no fewer than two days in advance of proposed interruption of electrical service.
   2. Do not proceed with interruption of electrical service without Engineer's and Owner's written permission.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of transfer switch or transfer switch components that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NEMA ICS 1.

C. Comply with NFPA 110.

D. Comply with UL 1008 unless requirements of these Specifications are stricter.

E. Tested Fault-Current Closing and Short-Circuit Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
   1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
      a. Where transfer switches do not have internal fault current protection, switches shall have AIC rating of 22 KA Symmetrical
   2. Short-time withstand capability for three cycles.

F. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.62. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.

G. Electrical Operation: Accomplish by a nonfused, momentarily energized solenoid or electric-motor-operated mechanism. Switches for emergency or standby purposes shall be mechanically and electrically interlocked in both directions to prevent simultaneous connection to both power sources unless closed transition.

H. Neutral Terminal: Solid and fully rated unless otherwise indicated.

I. Annunciation, Control, and Programming Interface Components: Devices at transfer switches for communicating with remote programming devices, annunciators, or annunciator and control panels shall have communication capability matched with remote device.

J. Factory Wiring: Train and bundle factory wiring and label, consistent with Shop Drawings, by color-code or by numbered or lettered wire and cable with printed markers at terminations. Color-coding and wire and cable markers are specified in Section 26 05 53 "Identification for Electrical Systems."
   1. Designated Terminals: Pressure type, suitable for types and sizes of field wiring indicated.
   2. Power-Terminal Arrangement and Field-Wiring Space: Suitable for top, side, or bottom entrance of feeder conductors as indicated.
   3. Control Wiring: Equipped with lugs suitable for connection to terminal strips.
   4. Accessible via front access.

K. Enclosures: General-purpose NEMA 250, [**Type 12**], complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.2 CONTACTOR-TYPE AUTOMATIC TRANSFER SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ASCO.
   2. Caterpillar
   3. Cummins Power Generation.
   4. Generac.

B. Comply with Level 1 equipment according to NFPA 110.

C. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
   1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are unacceptable.
   2. Switch Action: Double throw; mechanically held in both directions.
   3. Contacts: Silver composition or silver alloy for load-current switching. Contactor-style automatic transfer-switch units, rated 600 A and higher, shall have separate arcing contacts.
   4. Conductor Connectors: Suitable for use with conductor material and sizes.
   5. Material: Hard-drawn copper, 98 percent conductivity.
   6. Main and Neutral Lugs: Mechanical type.
   7. Ground Lugs and Bus-Configured Terminators: Mechanical type.
   8. Ground bar.
   9. Connectors shall be marked for conductor size and type according to UL 1008.

D. Automatic Delayed-Transition Transfer Switches: Pauses or stops in intermediate position to momentarily disconnect both sources, with transition controlled by programming in the automatic transfer-switch controller. Interlocked to prevent the load from being closed on both sources at the same time.
   1. Adjustable Time Delay: For override of normal-source voltage sensing to delay transfer and engine start signals for alternative source. Adjustable from zero to six seconds, and factory set for one second.
   2. Sources shall be mechanically and electrically interlocked to prevent closing both sources on the load at the same time.
   3. Fully automatic break-before-make operation with center off position.

E. Manual Switch Operation, Load-Breaking: Under load, with door closed and with either or both sources energized. Transfer time is same as for electrical operation. Control circuit automatically disconnects from electrical operator during manual operation.

F. Electric Nonautomatic Switch Operation: Electrically actuated by push buttons designated "Normal Source" and "Alternative Source." Switch shall be capable of transferring load in either direction with either or both sources energized.

G. Signal-Before-Transfer Contacts: A set of normally open/normally closed dry contacts operates in advance of retransfer to normal source. Interval shall be adjustable from 1 to 30 seconds.

H. Digital Communication Interface: Matched to capability of remote annunciator or annunciator and control panel.

I. Automatic Transfer-Switch Controller Features:

1. Controller operates through a period of loss of control power.
2. Undervoltage Sensing for Each Phase of Normal Source: Sense low phase-to-ground voltage on each phase. Pickup voltage shall be adjustable from 85 to 100 percent of nominal, and dropout voltage shall be adjustable from 75 to 98 percent of pickup value. Factory set for pickup at 90 percent and dropout at 85 percent.
3. Voltage/Frequency Lockout Relay: Prevent premature transfer to generator. Pickup voltage shall be adjustable from 85 to 100 percent of nominal. Factory set for pickup at 90 percent. Pickup frequency shall be adjustable from 90 to 100 percent of nominal. Factory set for pickup at 95 percent.
4. Time Delay for Retransfer to Normal Source: Adjustable from zero to 30 minutes, and factory set for 10 minutes. Override shall automatically defeat delay on loss of voltage or sustained undervoltage of emergency source, provided normal supply has been restored.
5. Switch-Position Pilot Lights: Indicate source to which load is connected.
6. Source-Available Indicating Lights: Supervise sources via transfer-switch normal- and emergency-source sensing circuits.
7. Transfer Override Switch: Overrides automatic retransfer control so transfer switch will remain connected to emergency power source regardless of condition of normal source. Pilot light indicates override status.
8. Engine Starting Contacts: One isolated and normally closed, and one isolated and normally open; rated 10 A at 32-V dc minimum.
9. Engine Shutdown Contacts:
    a. Time delay adjustable from zero to five minutes, and factory set for five minutes. Contacts shall initiate shutdown at remote engine-generator controls after retransfer of load to normal source.
10. Engine-Generator Exerciser: Solid-state, programmable-time switch starts engine generator and transfers load to it from normal source for a preset time, then retransfers and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from 7 to 30 days. Running periods shall be adjustable from 10 to 30 minutes. Factory settings shall be for 7-day exercise cycle, 20-minute running period, and 5-minute cool-down period. Exerciser features include the following:
    a. Exerciser Transfer Selector Switch: Permits selection of exercise with and without load transfer.
    b. Push-button programming control with digital display of settings.
    c. Integral battery operation of time switch when normal control power is unavailable.

2.3 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect components, assembled switches, and associated equipment according to UL 1008. Ensure proper operation. Check transfer time and voltage, frequency, and time-delay settings for compliance with specified requirements. Perform dielectric strength test complying with NEMA ICS 1.

B. Prepare test and inspection reports.
1. For each of the tests required by UL 1008, performed on representative devices, for emergency systems. Include results of test for the following conditions:
    a. Overvoltage.
    b. Undervoltage.
    c. Loss of supply voltage.
    d. Reduction of supply voltage.
    e. Alternative supply voltage or frequency is at minimum acceptable values.
    f. Temperature rise.
    g. Dielectric voltage-withstand; before and after short-circuit test.
    h. Overload.
    i. Contact opening.
    j. Endurance.

k. Short circuit.
l. Short-time current capability.
m. Receptacle withstand capability.
n. Insulating base and supports damage.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Annunciator and Control Panel Mounting: Flush in wall unless otherwise indicated.

B. Identify components according to Section 26 05 53 "Identification for Electrical Systems."

C. Set field-adjustable intervals and delays, relays, and engine exerciser clock.

D. Comply with NECA 1.

3.2 CONNECTIONS

A. Wiring to Remote Components: Match type and number of cables and conductors to generator sets, motor controls, control, and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.

B. Wiring Method: Install cables in raceways and cable trays except within electrical enclosures. Conceal raceway and cables except in unfinished spaces.
1. Comply with requirements for raceways and boxes specified in Section 26 05 33 "Raceways and Boxes for Electrical Systems."

C. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.

D. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

F. Connect twisted pair cable according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

G. Route and brace conductors according to manufacturer's written instructions . Do not obscure manufacturer's markings and labels.

H. Final connections to equipment shall be made with liquidtight, flexible metallic conduit no more than 18 inches in length.

3.3 FIELD QUALITY CONTROL

A. Administrant for Tests and Inspections:
1. Engage factory-authorized service representative to administer and perform tests and inspections on components, assemblies, and equipment installations, including connections.

B. Tests and Inspections:
1. After installing equipment, test for compliance with requirements according to NETA ATS.
2. Visual and Mechanical Inspection:
a. Compare equipment nameplate data with Drawings and Specifications.
b. Inspect physical and mechanical condition.
c. Inspect anchorage, alignment, grounding, and required clearances.
d. Verify that the unit is clean.
e. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
f. Verify that manual transfer warnings are attached and visible.
g. Verify tightness of all control connections.
h. Inspect bolted electrical connections for high resistance using one of the following methods, or both:
1) Use of low-resistance ohmmeter.
2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data.
i. Perform manual transfer operation.
j. Verify positive mechanical interlocking between normal and alternate sources.
k. Perform visual and mechanical inspection of surge arresters.
l. Inspect control power transformers.
1) Inspect for physical damage, cracked insulation, broken leads, tightness of connections, defective wiring, and overall general condition.
2) Verify that primary and secondary fuse or circuit-breaker ratings match Drawings.
3) Verify correct functioning of drawout disconnecting contacts, grounding contacts, and interlocks.
3. Electrical Tests:
a. Perform insulation-resistance tests on all control wiring with respect to ground.
b. Perform a contact/pole-resistance test. Compare measured values with manufacturer's acceptable values.
c. Verify settings and operation of control devices.
d. Calibrate and set all relays and timers.
e. Verify phase rotation, phasing, and synchronized operation.
f. Perform automatic transfer tests.
g. Verify correct operation and timing of the following functions:
1) Normal source voltage-sensing and frequency-sensing relays.
2) Engine start sequence.
3) Time delay on transfer.
4) Alternative source voltage-sensing and frequency-sensing relays.
5) Automatic transfer operation.
6) Interlocks and limit switch function.
7) Time delay and retransfer on normal power restoration.
8) Engine cool-down and shutdown feature.
4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
a. Check for electrical continuity of circuits and for short circuits.
b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
c. Verify that manual transfer warnings are properly placed.
d. Perform manual transfer operation.
5. After energizing circuits, perform each electrical test for transfer switches stated in NETA ATS and demonstrate interlocking sequence and operational function for each switch at least three times.

a. Simulate power failures of normal source to automatic transfer switches and retransfer from emergency source with normal source available.
b. Simulate loss of phase-to-ground voltage for each phase of normal source.
c. Verify time-delay settings.
d. Verify pickup and dropout voltages by data readout or inspection of control settings.
e. Test bypass/isolation unit functional modes and related automatic transfer-switch operations.
f. Perform contact-resistance test across main contacts and correct values exceeding 500 microhms and values for one pole deviating by more than 50 percent from other poles.
g. Verify proper sequence and correct timing of automatic engine starting, transfer time delay, retransfer time delay on restoration of normal power, and engine cool-down and shutdown.

6. Ground-Fault Tests: Coordinate with testing of ground-fault protective devices for power delivery from both sources.
   a. Verify grounding connections and locations and ratings of sensors.

C. Coordinate tests with tests of generator and run them concurrently.

D. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation and contact resistances and time delays. Attach a label or tag to each tested component indicating satisfactory completion of tests.

E. Transfer switches will be considered defective if they do not pass tests and inspections.

F. Remove and replace malfunctioning units and retest as specified above.

G. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain transfer switches and related equipment.

B. Coordinate this training with that for generator equipment.

END OF SECTION 26 36 00

SECTION 26 51 19 - LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Surface mount, linear.
   2. Suspended, linear.
   3. Materials.
   4. Luminaire support.

B. Related Requirements:
   1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
   2. Section 26 09 43.16 "Addressable-Luminaire Lighting Controls" and Section 26 09 43.23 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including reflector and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   6. Photometric data and adjustment factors based on laboratory tests , complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of luminaire.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Luminaires: One for every 100 of each type installed. Furnish at least one of each type

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:
1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Ambient Temperature: 41 to 104 deg F .
   1. Relative Humidity: Zero to 95 percent.

B. Altitude: Sea level to 1000 feet .

2.2 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Factory-Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when luminaires are in place.
   1. Label shall include the following luminaire characteristics:
      a. Luminaire model number, CCT, CRI, lumen output and wattage.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. California Title 24 compliant.

G. Internal driver

H. CRI of minimum 80. CCT as indicated by model number on plans.

I. L70 Rating of luminaire minimum of 100,000 hours.

J. Nominal Operating Voltage: 120 V - 277 V ac.

K. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

L. DesignLights Consortium qualified (DLC)

2.3 SURFACE MOUNT, LINEAR .

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Cooper Lighting Solutions; Signify North America Corp.
   2. Lithonia Lighting; Acuity Brands Lighting, Inc.

B. Nominal Operating Voltage: 120 V ac .

C. Lamp:
   1. Minimum 1500 lm.

2. Minimum allowable efficacy of 100 lm/W.
3. CRI of minimum 80 . CCT of 4000 K .
4. Rated lamp life of 100,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. Housings:
1. Extruded-aluminum housing and heat sink.
2. With integral mounting provisions.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:
1. Prismatic acrylic .
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

G. Standards:
1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.4 SUSPENDED, LINEAR

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Lighting Solutions; Signify North America Corp.
2. Lithonia Lighting; Acuity Brands Lighting, Inc.

B. Nominal Operating Voltage: 120 V ac .

C. Lamp:
1. Minimum 3,000 lm.
2. Minimum allowable efficacy of 110 lm/W.
3. CRI of minimum 80 . CCT of 4000 K .
4. Rated lamp life of 100,000 hours to L70.
5. Dimmable from 100 percent to zero percent of maximum light output.
6. Internal driver.
7. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

D. Housings:
1. Extruded-aluminum housing and heat sink.
2. With integral mounting provisions.

E. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

F. Diffusers and Globes:
1. Prismatic acrylic .
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

G. Standards:
1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.5 MATERIALS

A. Metal Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:
1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:
1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.6 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.7 LUMINAIRE SUPPORT

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage .

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaires:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Wall-Mounted Luminaires:
1. Attached to structural members in walls .
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaires:
1. Ceiling Mount:
   a. Four-point pendant mount with 5/32-inch- diameter aircraft cable supports .
   b. Hook mount.
2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling-Grid-Mounted Luminaires:

1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

H. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.

B. Luminaire will be considered defective if it does not pass operation tests and inspections.

C. Prepare test and inspection reports.

3.6 STARTUP SERVICE

A. Comply with requirements for startup specified in Section 26 09 43.16 "Addressable-Luminaire Lighting Controls."

3.7 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 51 19

SECTION 26 56 19 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
   1. Luminaire types.
   2. Materials.
   3. Finishes.
   4. Luminaire support components.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaire.
   4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 IES LM-80.
      a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
      b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
   6. Wiring diagrams for power, control, and signal wiring.
   7. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and photoelectric relays to include in operation and maintenance manuals.
1. Provide a list of all lamp types used on Project. Use ANSI and manufacturers' codes.
2. Provide a list of all photoelectric relay types used on Project; use manufacturers' codes.

1.7 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:
1. Luminaire manufacturers' laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products and complying with applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

D. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.9 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
a. Structural failures, including luminaire support components.
b. Faulty operation of luminaires and accessories.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 5 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LUMINAIRE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

D. UL Compliance: Comply with UL 1598 and listed for wet location.

E. CRI minimum of 70 . CCT per fixture schedule

F. L70 lamp life minimum of 100,000 hours.

G. Lamps dimmable from 100 percent to minimum of 10 percent of maximum light output.

H. Internal driver.

I. Nominal Operating Voltage: 120 V ac .

J. Source Limitations:
1. Obtain luminaires from single source from a single manufacturer.
2. For luminaires, obtain each color, grade, finish, type, and variety of luminaire from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 LUMINAIRE TYPES

A. Area and Site:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   a. Cooper Lighting Solutions; Signify North America Corp.
   b. Lithonia Lighting; Acuity Brands Lighting, Inc.
   c. RAB Lighting.
2. Luminaire-Mounting Height: As shown on plans. .
3. Diffusers and Globes: Clear glass .
4. Housings:
   a. Extruded-aluminum housing and heat sink.
   b. powder-coat finish.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum . Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
   1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
   2. Glass: Annealed crystal glass unless otherwise indicated.
   3. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

E. Lens and Refractor Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

F. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.

G. Housings:
   1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
   2. Provide filter/breather for enclosed luminaires.

H. Factory-Applied Labels: Comply with UL 1598. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when luminaire is in place.
   1. Label shall include the following luminaire characteristics:
      a. Luminaire model number, CCT, CRI, Lumen output, voltage and wattage.

2.4 FINISHES

A. Variations in Finishes: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

B. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

C. Factory-Applied Finish for Aluminum Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
   1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
   2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20 requirements; and seal aluminum surfaces with clear, hard-coat wax.
   3. Class I, Clear-Anodic Finish: AA-M32C22A41 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.
   4. Class I, Color-Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: Medium satin; Chemical Finish: Etched, medium matte; Anodic Coating: Architectural Class I, integrally

colored or electrolytically deposited color coating 0.018 mm or thicker), complying with AAMA 611.
a. Color: Per light fixture schedule .

D. Factory-Applied Finish for Steel Luminaires: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
1. Surface Preparation: Clean surfaces to comply with SSPC-SP 1, to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1 or SSPC-SP 8.
2. Exterior Surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.
a. Color:
1) As selected by Architect from manufacturer's full range.

2.5 LUMINAIRE SUPPORT COMPONENTS

A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Examine walls, roofs, for suitable conditions where luminaires will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is substantially complete, clean luminaires used for temporary lighting.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Fasten luminaire to structural support.

D. Wall-Mounted Luminaire Support:
1. Attached to a minimum 1/8 inch backing plate attached to wall structural members Attach to properly supported junction box per manufacturers recomendation .

E. Wiring Method: Install cables in raceways. Conceal raceways and cables.

F. Install luminaires level, plumb, and square with finished grade unless otherwise indicated. Install luminaires at height and aiming angle as indicated on Drawings.

G. Coordinate layout and installation of luminaires with other construction.

H. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33 "Raceways and Boxes for Electrical Systems" for wiring connections and wiring methods.

3.4 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Section 26 05 33 "Raceways and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.5 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.6 FIELD QUALITY CONTROL

A. Inspect each installed luminaire for damage. Replace damaged luminaires and components.

B. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
2. Verify operation of photoelectric controls.

C. Illumination Tests:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

D. Luminaire will be considered defective if it does not pass tests and inspections.

E. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.7 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain luminaires.

3.8 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied

conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 56 19

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
   2. Removing existing vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements including pavement, structures, and vaults.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Abandonment of buried structures

B. Related Sections:
   1. Division 01 Section "Temporary Facilities and Controls"
   2. Division 01 Section "Execution" for field engineering and surveying.

1.3 DEFINITIONS

A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings and defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

A. Except for stripped topsoil and spoils materials indicated to be stockpiled on-site, transported off-site to designated location or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or videotape.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

B. Shop Drawings:
   1. Plan for removing trees and other large vegetation not explicitly shown or indicated for removal in the Contract Documents.
   2. Plan showing proposed limits of clearing and grubbing, if different from clearing and grubbing limits shown or indicated in the Contract Documents.

C. Record Drawings: Identifying and accurately showing locations and elevations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

A. Preinstallation Conference: Conduct conference in accordance with Division 01.
   1. Review methods and procedures to maintain sensitive natural features, as identified by the Owner’s Representative.

1.7 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify MISS for area where Project is located before site clearing. Provide a minimum of three full working days advance notification.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

E. The following practices are prohibited within protection zones, the 100-year floodplain, and surrounding wetlands:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.

3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones, the 100-year floodplain, and surrounding wetlands.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones, the 100-year floodplain, and surrounding wetlands.

H. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist, as determined by the Engineer or Owner's Representative.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 23 33 "TRENCHING AND BACKFILL" as "Job Excavated Fill"
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide staking or flagging to delineate limits of areas to be cleared or grubbed as depicted on plans or directed by Owner's Representative. Review at site with Owner's Representative before commencing removal of trees, vegetation, and other materials to be removed.

B. Replace staking or flagging that is lost, removed, or destroyed, until clearing and grubbing work is complete and Owner's Representative allows removal of flagging.

C. Protect and maintain benchmarks and survey control points to remain from disturbance during construction. Contractor shall be responsible for re-establishing benchmarks and control points that have been disturbed or damaged by the work. Benchmarks and control points in demolition areas shall be re-established in non-demolition areas by the Contractor's surveyor, prior to disturbance.

D. Protect existing site improvements to remain from damage during construction. Existing site improvements include, but are not limited to, streets, parking lots, sidewalks, curb and gutter. driveways, structures, underground facilities to remain, adjacent property, and structures.
1. Restore damaged improvements to their original condition, as acceptable to Owner, at Contractor's expense.

E. Place removed materials in salvage area as indicated by Owner's Representative.

3.2 TEMPORARY EROSION SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures in accordance with Part 91, Act 451, PA 1994, the Soil Erosion and Sedimentation Control Act, Michigan Department of Natural Resources Environmental Act guidelines and all pertinent local enforcing agency rules and regulations having jurisdictions prior to beginning site clearing.

3.3 TREE PLANT PROTECTION

A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Owner's Representative. Trees and shrubs intended to remain, that are damaged beyond repair or that are removed, shall be replaced by Contractor at no additional cost to Owner.

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
   1. Coordinate with utility owners as required for shutting off service.

B. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner not less than five days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

C. Excavate for and remove underground utilities indicated to be removed after Owner's permission has been obtained. Notify property owners and residents of proposed interruption schedule two days in advance of interruption.

3.5 CLEARING GRUBBING

A. Prior to the start of construction, the Contractor shall verify the limits of trees and other items that are to be saved. The Contractor shall then clear the site or trench excavation area of all remaining trees, brush, and other miscellaneous items that are not to be saved.

B. Remove obstructions, trees (including stump and main roots), shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods for grubbing within protection zones.
   4. Chip removed tree branches.
   5. Dispose of all trees, shrubs, stumps, root, and all associated foliage and debris offsite.
   6. Trees less than six (6) inch diameter shall be removed where required by the work as incidental to the Contract.
   7. The Contractor shall abide by any easement agreements regarding the tree removal work and wood ownership.
   8. Clear undergrowth and deadwood without disturbing subsoil.

9. Do not use cleared or grubbed materials as fill, backfill, or in embankments.

C. Fill depressions caused by clearing and grubbing operations in accordance with the materials and procedures as specified in Section 31 23 00 “Excavation and Fill”, unless the depressions are in an area requiring excavation per plan.

D. Stump Removal: Where called for on the plans, the Contractor shall remove existing stumps, including main roots (two (2) inch diameter and larger), dispose of all associated debris offsite, and backfill the void as above.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth indicated on drawing in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials. Topsoil stockpiles that have been contaminated by subsoil or nonsoil materials, as determined by the Owner’s Representative, shall be removed from the site at the Contractor’s expense. The contractor shall replace, at his expense, any topsoil needed to replace the contaminated topsoil removed due to contamination.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
   1. Limit height of topsoil stockpiles to 72 inches.
   2. Do not stockpile topsoil within protection zones, the 100-year floodplain, and surrounding wetlands.
   3. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 IMPROVEMENT REMOVAL

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

C. Remove fencing where removal is designated on the drawings.

3.8 STRUCTURE ABANDONMENT

A. Underground utility structures indicated for abandonment shall be abandoned as follows:
   1. Salvage and stockpile, without damaging, castings, grates, and covers or dispose at the direction of the Owner.
   2. Remove and dispose of the cone, masonry, and riser sections such that the remaining structure is no higher than 3 feet below the proposed finish grade.

3.9 DISPOSAL OF SURPLUS WASTE MATERIALS

A. Stockpile all surplus soil material in the area designated on the construction drawings.

B. Remove, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

C. Do not burn clearing debris at the site, unless approved by Owner and authorities having jurisdiction. If burning is permitted, comply with requirements of authorities having jurisdiction and Owner’s requirements.

END OF SECTION 311000

SECTION 31 23 00 - EXCAVATION AND 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.

B. ASTM D 2487 “Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

C. ASTM D 6938 “Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods”

D. ASTM D 1557 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort”

E. Michigan Department of Transportation Density Testing and Inspection Manual (rev 2014)

1.2 SUMMARY

A. Work shall include furnishing of labor, materials, tools, equipment, accessories, and services necessary for completing the excavation and backfilling for the items as shown on the contract drawings and/or as herein required. This also includes excavation, dewatering, earth moving, placement, grading and compaction of earth, and the disposal of excess materials.

B. Section Includes:
1. Excavation
2. Fill / Embankment
3. Preparing subgrades for slabs-on-grade, sidewalks, pavements, turf, grasses and plants.
4. Cutting, grading, filling, compacting and rough contouring the site for structures, walks, pavements, and drainage.
5. Placing Topsoil for Site Restoration
6. Surplus Material Hauling

C. Related Sections:
1. Division 01 Section “Temporary Facilities and Controls”.
2. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Division 31 Section “Trenching and Backfilling” for excavation, bedding, and backfill of underground utilities.
4. Division 33 Sections for installing underground utilities and buried structures.

1.3 DEFINITIONS

A. Base Course: Aggregate layer placed between the subbase course or subgrade and paving.

B. Backfill: material places in an excavated area

C. Borrow Soil: Soil imported from off-site for use as fill or backfill, as approved by the Engineer

D. Embankment: Fill soils placed and compacted such that future site improvements will be constructed above or near the placed soils

E. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Owner's Representative. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owner's Representative. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

F. Fill: material placed above the original or natural ground line.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, utility appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

I. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

J. Suitable Earth Material: job excavated fill or borrow material that meets the requirements of this section for Fill.

K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. None.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. None.

C. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to D 2487 (USCS).
   2. Laboratory compaction curve according to ASTM D 1557 (Modified Proctor)

D. Pre-excavation Photographs or Video Recording: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference in accordance with Section 01 31 00 “Project Management and Coordination”

B. References to Michigan Department of Transportation (MDOT) Specifications shall pertain to the current edition of the Standard Specifications for Construction.

1.6 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify MISS for area where Project is located before beginning excavation. Provide a minimum of three full working days advance notification.

C. Do not commence earth-moving operations until temporary erosion- and sedimentation-control measures are in place.

D. Do not commence earth-moving operations until plant-protection measures are in place, if applicable.

E. The following practices are prohibited within protection zones, 100-year floodplain and wetlands:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones, 100-year floodplain and wetlands.

G. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones, 100-year floodplain and wetlands.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS - GENERAL

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

2.2 FILL / EMBANKMENT

A. Fill and Embankment have the same requirements under this contract. References in the plans to embankment and fill shall be considered references to the same material requirements.

B. Suitable Earth Material shall be either of the following, with approval of the Owner's Representative:
   1. Job Excavated Fill shall be defined as material excavated from the site that can be classified as GW, GP, GM, SW, SP, and SM according to ASTM D 2487 or a combination of these groups and is free from frozen earth, boulders, rocks, stones larger than 3 inch in size, debris, vegetation, blue and gray clay, and organic material.
   2. Granular Fill:
      a. Granular fill shall be defined as sharp sand, gravel, or crushed stone that is free from lumps of clay and soft or flaky material and shall conform to requirements of MDOT Specification Section 902.07 and the gradation of MDOT Specification Table 902-3 for MDOT Class I
      b. Granular material shall be used for fill work located under or within the influence of roadway surfaces, structures, or other constructed site improvements. Project plan details or the Engineer shall dictate which Class of granular material is required for the project.
      c. Material excavated from the trench may be used as granular fill when, in the opinion of the Owner's Representative, it meets the granular backfill grading requirements.

C. Topsoil
   1. Stripped and re-used material or local borrow material.
   2. Graded.
   3. Free of roots, rocks larger than ½ inch, subsoil, debris, weeds, and foreign matter.
   4. Contains no greater than 20 percent nor less than 5 percent organic matter.

D. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that survey benchmark and intended elevations for the Work are as indicated on the plans.

3.2 PREPARATION

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

B. Protect benchmarks, fences, structures, utilities, sidewalks, pavements, protection zones, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

C. Protect plant life, lawns, trees and shrubs, and other features to remain as a portion of final landscaping.

D. Protect and maintain erosion and sedimentation controls during earth moving operations.

E. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.3 CLASSIFICATION OF EXCAVATION

A. Earth, as a name for excavated material, shall include all glacial deposits whether cemented or not, except solid boulders one-half cubic yard or more in volume. It shall also include all alluvial deposits and material of every kind that can be excavated with equal facility by the equipment and means typically used for earth excavation.

B. Peat, as a name for excavated material, shall include all unstable organic soils such as peat, muck, marl, and underlying very soft clay.

C. Rock, as a name for excavated material, shall include pre-glacial solid ledge rock that can be removed most practically by blasting, barring or wedging, or by some other standard method of quarrying solid rock. It shall also include solid boulders of one-half cubic yard or more in volume as well as existing concrete, masonry with mortar joints, or other existing structural work that can be excavated practically only by methods of quarrying solid rock. It shall not include fragile, friable, or disintegrated materials of any kind that can be excavated by equipment and means used for earth excavation.

3.4 SUBGRADE ELEVATION

A. Contractor, or his surveyor, shall calculate the subgrade elevation required for excavation and fill work by referencing the proposed final grade and back-calculating the subgrade elevation based on the project plans, details, specifications, and/or direction of the Owner's Representative regarding the finish surface or pavement cross section.

3.5 EXCAVATION, GENERAL

A. Remove topsoil in accordance with Section 31 10 00 "SITE CLEARNING" from area of construction, areas to be filled and graded, and other areas designated.

B. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction.

3.6 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
   1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
   2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
   3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch (25 mm). Do not disturb bottom of excavations intended as bearing surfaces.

3.7 METHODS OF EXCAVATION IN EARTH

A. All excavation shall be by open cut from the surface using appropriate and efficient equipment to handle the materials.

B. Stockpile excavated topsoil and subsoil material classified by Owner's Representative as suitable for further used and remove material classified as unsuitable and material in excess of project requirements.

3.8 EXCAVATION FOR WALKS, PAVEMENTS ROADWAYS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

B. Roadway earthwork shall be performed in accordance with the construction methods that are described in MDTO Section 205 Roadway Earthwork unless otherwise called for in the plan notes, details, or supplemental specifications.

3.9 EXCAVATION FOR UTILITY TRENCHES

A. Trench excavation and backfill shall be in accordance with Section 31 23 33 "Trenching and Backfill"

3.10 EXCAVATION FOR SITE GRADING

A. Excavate areas identified on the plans where final or proposed grades are lower than existing or interim grades in areas for proposed pavement, walks, utility construction, open space, or other proposed feature.

B. Contractor shall maintain the overall storm water flow direction of the site until measures and utilities are in place to manage the modified or final flow condition.

C. Contractor shall prepare subgrade in excavation areas by smoothly grading and compacting the surface with equipment necessary to achieve the specified density.

D. Contractor shall be responsible for staking excavation areas to prevent unauthorized excavation and to ensure that the subgrade elevations are achieved.

3.11 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Owner's Representative.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Owner's Representative.

3.12 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and job excavated soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile materials on-site at approved locations and so as not to impede the natural drainage in the area.
   2. Stockpile in sufficient quantities to meet project requirements.
   3. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
   4. Do not store in protection zones, 100-year floodplain, or wetlands, as identified on the plans.

3.13 STOCKPILE CLEANUP

A. Remove stockpile; leave area in a clean and neat condition. Grade site surface to prevent free standing surface water. If approval given by Owner, leave unused materials in a neat, compact stockpile.

B. If a borrow area is indicated, leave area in a clean and neat condition. Grade site surface to prevent free standing surface water.

3.14 TRANSPORT OF NATIVE MATERIALS OFFSITE

A. If the Contractor encounters suitable materials (sand, gravel, topsoil, etc.) during the course of construction, he shall not be allowed to transport these materials offsite. Wherever possible, suitable native sands and gravels shall be used as backfill rather than transporting them to the spoils berm and replacing them with non-native materials of a lesser quality.

3.15 EMBANKEMENT

A. Construction requirements for Fill and Embankment are the same under this contract. References on the plans and in the specifications to “Embankment” shall be placed, compacted, and tested according to the provisions of this section for “Fill”

3.16 FILL

A. Construction requirements for Fill and Embankment are the same under this contract. References on the plans and in the specifications to “Fill” or “Embankment” shall be placed, compacted, and tested according to the provisions of this section.

B. Contractor shall fill with suitable earth material (see “PART 2 – PRODUCTS”) the areas identified on the plans where final or proposed grades are higher than existing or interim grades in areas for proposed pavement, walks, structures, utility construction, open space, or other proposed feature.

C. Contractor shall place fill on soils free of mud, frost, snow, or ice.

D. Contractor shall maintain the overall storm water flow direction of the site until measures and utilities are in place to manage the modified or final flow condition.

E. Contractor shall prepare subgrade in fill areas by smoothly grading and compacting the surface with equipment necessary to achieve the specified density.

F. Fill material shall consist of granular fill for areas within the influence of proposed pavements or structures. Job excavated fill may be used elsewhere, except when compaction cannot be achieved.

G. Contractor shall place fill material in 12 inch lifts unless the Contractor can demonstrate to the satisfaction of the Owner's Representative that he can consistently attain the specified density on thicker lifts. Compact the entire lift in accordance with "COMPACTION" to the specified density before placing an additional lift. This procedure shall be repeated until all areas have reached indicated subgrade elevation.

H. Contractor shall be permitted to place excavated material that does not meet the product requirements of Suitable Earth Material only as directed and approved by the Owner's Representative.

3.17 COMPACTION OF FILL / SUBGRADE

A. Where plans, details, or specifications call for subgrade or other soil to be compacted, such material shall be compacted according to this section for "Fill."

B. If the moisture content of cohesive fill material exceeds the optimum moisture content for maximum density by more than three percent (3%), the Contractor shall dry the material to meet the foregoing moisture content limitation or provide, at his own expense, Granular Fill. No sloppy or wet backfill will be allowed, as determined by the Owner's Representative.

C. Specified compaction shall be obtained with the use of a bulldozer, sheepsfoot roller, vibratory roller, mechanical tamper, or other similar and effective equipment. Specified compaction for areas under structures, building slabs, pavements and sidewalks means not less than 95 percent (not average 95 percent) of all tests of maximum unit weight when tested in accordance with ASTM D 6938 (nuclear gauge). Specified compaction for areas under lawn or unpaved areas means not less than 90 percent (not average 90 percent) of all tests of maximum unit weight when tested in accordance with ASTM D 6938 (nuclear gauge).

D. Compaction equipment or methodology shall be altered by the Contractor if the Owner's Representative determines that the methodology is not capable of consistently compacting suitable material to the specified density. Additional equipment, labor, or time as required by this procedural change shall be at the expense of the Contractor.

E. Maximum unit weight will be determined by ASTM D 1557 (modified proctor), current methods of Test for Compaction and Density of Soil, AASHTO Designation T-180 or by the Cone Density Method developed by MDOT, as directed by the Owner or Owner's Representative.

F. If job excavated material is not suitable to obtain 95 percent minimum compaction, the Contractor shall, at his expense, remove unsuitable materials and replace with granular fill materials, to obtain ninety-five percent (95%) minimum compaction as specified.

G. Compaction tests will be made by a representative of the Owner and paid for by the Owner, unless otherwise specified in the Contract Documents.

H. Any depression resulting from settlement of any material prior to the date of final payment for all work under this contract shall be brought to the proper grade and surface and made to match the adjacent surface. Any damage to pavement, landscaping, or structures resulting from settlement

in areas compacted by the Contractor shall be repaired or replaced at the direction and to the approval of the Owner's Representative at no additional cost to the Owner.

I. Compaction Under structures
   1. Compact structure embankment to 100 percent of the maximum unit weight within the limits of 1:1 slopes, extending outward and downward from the bottom edges of the structure footings.

3.18 SUBGRADE INSPECTION

A. Notify Owner's Representative when excavations and fills have reached required subgrade elevation/

B. If Owner's Representative determines that unsatisfactory soil is present in an excavation area, continue excavation and replace with compacted backfill or fill material as directed.

C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Representative, without additional compensation.

E. Areas to receive slab on grade concrete or pavement shall be proof rolled by the Contractor and accepted by the Owner's Representative prior to installation of further work.

3.19 SURPLUS MATERIAL HAULING

A. Limited quantities of job excavated fill which are not required for site grading, construction of embankments, backfill, or other earthwork requirement at the project site as shown or described in the Contract Documents shall be hauled to and placed on the spoils berm as shown on the construction drawings.

B. Excess excavated soil material shall be hauled to the spoils berm prior to beginning any fill or embankment operations.

C. Placement, compaction, and testing of material at the spoils berm location shall be in accordance with the compaction listed above for lawn and unpaved areas or as specified per the direction of the Owner's Representative.

D. Contractor shall transport surplus material in vehicles designed for transporting earth on public roads.

E. Contractor shall comply with any and all procedure as directed and decided by the Owner's Representative or Owner to measure the weight, mass, or volume of materials which are hauled to the spoils berm.

3.20 DISPOSAL OF EXCAVATED MATERIAL

A. After all suitable excavated material shall be utilized as fill on site or as fill at an off-site location as directed by the Owner or Owner's Representative. Placement of excavated material at off-site location(s) shall be in accordance with the direction of the off-site owner or separate contract documents.

B. Excess excavated material shall be placed on the on-site spoils berm, as directed by the Owner's Representative.

C. The Contractor shall also be responsible for disposing of all excavated soil materials that are unsuitable for use as fill or backfill at the on-site spoils berm. All other unsuitable materials may include, but are not limited to, broken concrete, asphalt, rock, and other non-soil debris. The Contractor shall be required to obtain his own disposal areas and permits and shall receive no additional compensation for this disposal work.

D. Surplus or unsuitable material shall not be disposed of either temporarily or permanently beyond the plan grading limit line or across any wetland or flood plain unless the plans provide for such placement.

3.21 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades and between utility structure rims and adjacent earthwork
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
   3. Slope grade away from building at a minimum of 2 inches in 10 feet, unless noted otherwise.

B. Site Rough Grading: Slope grades to direct water away from buildings and structures to prevent ponding. Finish subgrades to required elevations within the following tolerances:
   1. Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

D. Final Cleanup and Grading: Upon completion of the construction, and before final payment is made, the Contractor shall restore his working area to as clean a condition as existed before his operations were started. He shall go over the entire line and refill any place that may have settled. He shall then re-grade and put in shape all backfilled trenches, all fills he may have made from excess excavated materials, and all other areas that may have been disturbed through all operations.

3.22 SUBSURFACE DRAINAGE

A. Subdrainage Pipe: As specified on drawings and in accordance with Section 33 42 00 "Storm Conveyance"

3.23 FIELD QUALITY CONTROL

A. Testing Agency: Owner may engage a qualified geotechnical engineering testing agency to perform the following tests and inspections.
   1. Determine prior to placement of fill that site has been prepared in compliance with requirements.
   2. Determine that fill material and maximum lift thickness comply with requirements.

3. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Contractor shall engage a qualified land surveyor to perform all staking and layouts. Surveyor shall utilize the design datum and pre-construction benchmarks to ensure accurate excavation and fill according to the project plans.

D. When testing agency reports that subgrades, fills, or backfills have not achieved the degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.24 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Owner's Representative; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.25 CONTACTOR SAFETY REQUIREMENTS

A. The excavation and fill operations shall be conducted by the Contractor in a manner that will provide safe working conditions for all persons on the site who may be affected by the Work. The Contractor shall also conduct his operations in a manner that will protect adjacent property from damage.

B. Trench sides shall be either cut back to the slope as necessitated by soil and ground water conditions which will provide stable sides, or supporting systems shall be installed that are capable of restraining the earth sides from movement. A qualified employee of the Contractor shall design the trench supporting systems.

C. The Contractor shall employ, at all times at the site of the work, a qualified person who will be responsible for the safety of both the work and workmen, and who will make all the decisions relevant to the stability of trenches, the adequacy of any and all protective devices, proper operation of equipment, and all other matters related to safety.

D. The Contractor shall not store, along and adjacent to the trench, excavated material, heavy equipment, backfill materials, sewer pipe, or other construction materials which may impose too great a load on the earth and cause displacement or caving of the earth. The Contractor shall, at all times, provide a safe means of emergency exit from all trench excavations.

END OF SECTION 312300

SECTION 31 23 33 - TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Retain or delete this Article in all sections of the Project Manual.

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

C. ASTM D 6938 “Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods”

D. ASTM D 1557 “Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort”

E. Michigan Department of Transportation Density Testing and Inspection Manual (rev 2014)

1.2 SUMMARY

A. Work shall include furnishing of labor, materials, tools, equipment, accessories, and services necessary for completing the excavation and backfilling for the items as shown on the contract drawings and/or as herein required. This also includes trenching, trench or undercutting, complete and continual drainage of excavation, sheeting, bracing, and shoring of sides of the excavation, backfilling around structures and over pipelines, and the disposal of excess excavated material.

B. Section includes:
1. Excavating and backfilling for structures.
2. Subsurface drainage backfill for walls and trenches.
3. Excavating and backfilling trenches for utilities, piping, and pits for buried utility structures.
4. Trench Backfill Compacted-in-Place (CIP).
5. Trench Undercut and Refill.
6. Dewatering.

C. Related Section:
1. Division 01 Section “Temporary Facilities and Controls”.
2. Division 31 Section "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.

1.3 DEFINITIONS

A. Backfill: Soil material or flowable fill used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

C. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated or to elevation necessary for buried pipe or structure installation or construction.
   1. Authorized Additional Excavation: Excavation below trench bottom or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
   2. Unauthorized Excavation: Excavation below trench bottom elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

D. Fill: Soil materials used to raise existing grades.

E. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, utility appurtenances and structures, or other man-made stationary features constructed above or below the ground surface.

F. Subbase Course: Aggregate layer placed between the subgrade and base course for asphalt or concrete pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a paved walk.

G. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

H. Trenching: Excavation for installation of pipe or conduit utilities.

I. Utilities: Underground pipes, drains, conduits, ducts, and cables, as well as underground services within buildings.

1.4 SUBMITTALS

A. Samples for Verification: For the following products, in sizes indicated below:
   1. Warning tape: 12 inches long; of each color.

B. Material Test Reports: For each borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 1557.

C. Pre-excavation Photographs or Video Recording: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.5 QUALITY ASSURANCE

A. Pre-excavation Conference: Conduct conference at Project site as directed by the Owner's Representative.

B. References to Michigan Department of Transportation (MDOT) Specifications shall pertain to the current edition of the Standard Specifications for Construction.

1.6 PROJECONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during trenching operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify MISS DIG for area where Project is located before beginning earth moving operations or excavation. Provide a minimum of three full working days advance notification. Do not commence excavation until marking, flagging, and/or clearing by local facility and utility owners has been completed.

C. Do not commence earth-moving or excavation operations until temporary erosion- and sedimentation-control measures are in place.

D. Do not commence trenching operations until plant-protection measures are in place, if applicable.

E. The following practices are prohibited within protection zones, 100-year floodplain and wetlands:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.
   5. Impoundment of water.
   6. Excavation or other digging unless otherwise indicated.
   7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

F. Do not direct vehicle or equipment exhaust towards protection zones, 100-year floodplain and wetlands.

G. Contractor shall prohibit heat sources, flames, ignition sources, and smoking within or near protection zones, 100-year floodplain and wetlands.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS – GENERAL

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations for use as fill or backfill.

2.2 BEDDING AND BACKFILL MATERIALS

A. Granular bedding and backfill shall be defined as sand, gravel, crushed stone, slag or a blend of aggregates that is free from lumps of clay and soft or flaky material meet the requirements of Section 902.07 and Table 902-3 of the MDOT Standard Specifications for Construction.
   1. Job excavated material may be used as granular backfill when, in the opinion of the Engineer or Owner's Representative, it meets the granular backfill grading requirements and is approved by them for use as granular backfill.

B. Bedding material shall be provided from offsite unless the trench passes through a well-defined strata of sand or gravel as determined by the Engineer or Owner's Representative. Bedding material shall be subject to the approval of the Engineer or Owner's Representative.

C. Stone bedding and backfill natural gravel, slag, or crushed gravel and shall meet the requirements of Section 902.03, Table 902-1 and Table 902-2 of the MDOT Standard Specifications for Construction.

D. Excavated Backfill: Job excavated backfill shall be defined as material excavated from the trench or elsewhere on-site that is free from the following: frozen earth, boulders, rocks, stones larger than 3 inch in size, debris, blue and gray clay, and organic material.

E. Crushed portland cement concrete may be used by as granular and stone bedding and/or backfill only if approved by the Owner's Representative.

2.3 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, curbs, protection zones, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by trenching and backfill activities.

B. Protect and maintain erosion and sedimentation controls during earth moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 PAVEMENT CUTS

A. Where a trench must be cut through pavement, driveway, or sidewalk, particular care shall be taken to avoid unnecessary damage to adjoining areas of the pavement, driveway or sidewalk to remain. All cuts through existing surfaces shall be made full-depth with a concrete saw. Cuts in concrete pavement shall be made parallel with longitudinal and transverse construction or contraction joints.

B. Saw cuts in concrete pavement shall not be nearer than five feet (5'-0") to a transverse joint, to the centerline of pavement, or to the edge of pavement or curb, i.e., no existing or replacement pavement shall be less than five feet (5'-0") in width. If the damaged pavement or surfacing is nearer than five feet (5'-0") to a joint or centerline of pavement , or to edge of pavement, surfacing

or curb, removal and replacement shall be extended to said joint, centerline, edge of pavement, surfacing, or curb. These same requirements shall apply to the saw cutting and replacement of concrete driveways.

C. If a square, block, or flag of sidewalk is cut, broken, or cracked, the entire square or block shall be removed and replaced.

3.3 EXCAVATION AND TRENCH DEWATERING

A. The Contactor shall maintain any excavation or trench free of water during construction of any structures and/or utilities. Any and all dewatering methods are considered to be incidental to the contract unless noted as otherwise elsewhere in the Contract Documents.

B. The Contractor shall take adequate precautions to control the discharge of dewatering pumps so as to prevent soil erosion or sedimentation of drainage ditches, structures, storm sewers, culverts, natural drainage courses, ponds, lakes or wetlands.

C. The Contractor shall insure that discharge from any dewatering operations has a suitable outlet and that it will not cause any damage to adjacent dwellings or property. Water and discharge hoses shall be placed and/or controlled so as to prevent a hazard to pedestrians or motor vehicles passing in the vicinity of the construction site.

D. The Contractor shall not directly discharge water to a storm sewer prior to treatment by one of the following methods, demonstrated to and approved by the Owner's Representative. The approved methodology shall be considered incidental to the contract.
   1. Sediment filter bag or silt sack.
   2. Turf or grass filtering (erosion control must be maintained).
   3. Sedimentation pond.

E. Electric pumps shall have suitable power supply and appurtenances meeting NEC requirements and properly fused and grounded to prevent electrical shock hazards to on-site personnel.

F. Internal combustion engine driven pumps, if operated 24 hours per day, shall have adequate exhaust silencers in good repair to muffle engine noise to an acceptable level for the area where located.

3.4 CLASSIFICATION OF EXCAVATION

A. Earth, as a name for excavated material, shall include all glacial deposits whether cemented or not, except solid boulders one-half cubic yard or more in volume. It shall also include all alluvial deposits and material of every kind that can be excavated with equal facility by the equipment and means typically used for earth excavation.

B. Peat, as a name for excavated material, shall include all unstable organic soils such as peat, muck, marl, and underlying very soft clay.

C. Rock, as a name for excavated material, shall include pre-glacial solid ledge rock that can be removed most practically by blasting, barring or wedging, or by some other standard method of quarrying solid rock. It shall also include solid boulders of one-half cubic yard or more in volume as well as existing concrete, masonry with mortar joints, or other existing structural work that can be excavated practically only by methods of quarrying solid rock. It shall not include fragile, friable, or disintegrated materials of any kind that can be excavated by equipment and means used for earth excavation.

3.5 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, as determined by the Engineer, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction.

3.6 METHODS OF EXCAVATION IN EARTH

A. All excavation shall be by open cut from the surface, except in special cases where trenchless utility installation is required on the plans and approved by the Owner. All excavation shall be made in such a manner and to such depth, length, and width as will give ample room for building the structures, bracing, sheeting, and supporting the sides of the excavation, pumping and drainage of ground water and sewage which may be encountered, and removal of all materials excavated. Special care shall be taken so that the soil below the bottom of structures and utilities to be built shall be left undisturbed so that a firm bed will be provided for construction. Any voids shall be backfilled with suitable granular material and shall be compacted in accordance with this section.

3.7 EXCAVATIN FOR STRUCTURES

A. Excavation for Underground Tanks, Basins, and Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
   1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.

3.8 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. General.
   1. Excavation shall be of sufficient width and depth to provide adequate room for construction and installation of the work to the lines, grades and dimensions called for on the plans. Unless otherwise called for in the Contract Documents, the width of a trench from the pipe invert to a height twelve (12) inches above the top of the pipe barrel shall be indicated as follows:
      a. Pipe diameter 4” through 12”: Maximum trench width = 30”.
      b. Pipe diameter 4” through 12”: Maximum trench width = 30”.
   2. If the maximum trench width as specified above is exceeded, unless otherwise shown on the drawings, the Contractor shall install, at his own expense, such concrete cradling or other bedding as is approved by the Owner’s Representative or Engineer, to support the added load of the backfill.

3. 2.Where trench excavation is in granular material, the last six (6) inches of trench depth shall be carefully excavated and trimmed by hand to the exact elevation and contour of pipe. Where trench excavation is in rock or clay soil, the trench bottom shall be undercut a minimum of four (4) inches below the final bottom elevation of pipe. The bedding material as hereinafter specified shall be placed and compacted to the underside of the pipe.
4. Excavation for structures shall be made to the outside lines and surfaces of such structures wherever it is practicable to build directly against the sides and bottoms of excavations. In such cases, care shall be taken not to disturb the original foundation or backing. Final trimming shall be done by hand just before construction of the structure. If excess excavation is made, or the material becomes disturbed so as to require removal beyond the prescribed limits, the resulting space shall be refilled with bedding, as specified hereinafter, and solidly machine tamped into place to 95 percent of maximum unit weight before the construction work proceeds.
5. Excavation for structures shall be extended sufficiently beyond the limits of the structure to provide ample room for form construction and other construction methods to be followed, wherever necessary.

C. Bedding:
1. Where the subgrade below the bottom of the pipe is disturbed during the construction, the space shall be refilled with granular or stone bedding solidly tamped to form a firm foundation for the pipe.

D. Amount of Trench Opening:
1. Not more than 50 lineal feet of trench shall be open at one time in advance of the pipe unless permitted by the Owner's Representative. The length of street that may be occupied by the construction work at any one time shall be subject to the direction of the Owner and will be based on requirements of the use of the street by the public or Owner. No more than 600 consecutive feet of street length shall be occupied at one time, and vehicle traffic through the street shall not be entirely stopped without permission of the Engineer. After placement of the utility line, the Contractor shall backfill the trench promptly in order to minimize the length of open trench and avoid any unsafe conditions.

E. Trenches in Tree-and-Plant-Protection Zones:
1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.9 TRENCH INSPECTION

A. Notify Owner's Representative when excavations have reached required elevation for bedding or structure foundation.

B. Trench undercut: If the Owner's Representative determines that unsatisfactory soil is present or that the soil at the bottom of the trench is instable, the contractor shall continue trenching below the elevations needed for pipe bedding and replace with compacted stone refill or granular backfill as directed by the Owner's Representative. Trench undercut up to 18 inches below the bottom of the typical or per plan detail trench shall be performed at no additional cost to the Owner.

C. Contractor shall reconstruct trench soils damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by the Engineer.
   1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Engineer or Owner's Representative.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.
   2. Do not store in protection zones, 100-year floodplain, or wetlands, as identified on the plans.

3.12 TRANSPORT OF NATIVE MATERIALS OFFSITE

A. If the Contractor encounters suitable materials (sand, gravel, topsoil, etc.) during the course of construction, he shall not be allowed to transport these materials offsite. Wherever possible, suitable native sands and gravels shall be used as backfill rather than transporting them to the on-site spoils berms and replacing them with non-native materials of a lesser quality.

3.13 DIVERTING EXISTING SEWERS

A. Where existing sewers or drains are encountered in the work, adequate provision shall be made for diverting flow in the existing sewers so that the excavation will be kept dry during the progress of the construction work. Upon completion of the construction work, the existing sewers shall be restored or otherwise provided with an adequate outlet as directed by the Owner's Representative. Sewer diversion shall be considered incidental to the project.

3.14 SHEETING, BRACING, SHORING

A. Where required to properly support the surfaces of excavations to protect the construction work, adjacent work or workers, sheeting, bracing and shoring shall be provided by the contractor. If the Owner's Representative determines that at any point sufficient or proper supports have not been provided, he may order such additional supports at the expense of the Contractor, but neither the placing of such additional supports by the order of the Owner's Representative nor failure of the Owner's Representative to order such additional supports placed shall release the Contractor from his responsibility for the sufficiency of such supports and the integrity of the work. In removing the sheeting and bracing after the construction has been completed, special care shall be taken to prevent any caving of the sides of the excavation and injury to the completed work or to the adjacent property.

3.15 SHEETING LEFT IN PLACE

A. Sheeting, bracing and shoring shall not be left in place after completion of the work except as required by the Engineer or Owner's Representative. Where sheeting, bracing, and shoring must be left in place in order to protect the work, adjacent structures, or property, it shall be cut off or left not less than two (2) feet below the finish surface grade. If sheeting, shoring or bracing must be left in place, then it shall be paid for at the contract unit bid price that is shown on the Bid Form. If a pay item was not included on the Bid Form, then a work order shall be negotiated.

3.16 CROSSING EXISTING STRUCTURES AND PIPES

A. During construction, it may be necessary to cross under certain sewers, drains, culverts, water lines, gas lines, electric conduits and other underground structures. Every effort shall be made to prevent damage to such structures. Wherever such structures or utilities are disturbed or broken, they shall be restored to good working condition. Compacted granular backfill shall be placed around, above, and below such utilities as described in the section pertaining to backfilling. MDOT Grade S3 concrete shall be utilized where directed by the Engineer or Owner's Representative at no additional cost to the project. Either granular backfill or concrete shall be brought to, at minimum, the spring line of the higher utility.

3.17 TUNNELING TREES

A. Trees eight (8) inches in diameter or less will require a minimum tunnel length of eight (8) feet. Trees over eight (8) inches in diameter, measured four (4) feet above the ground surface, will require a minimum tunnel length equal to one foot for each inch of tree diameter.

B. Trees shall be tunneled whenever any portion of an excavation approaches within a distance equal to one-half the required tunnel length except as otherwise noted on the plans.

C. Tunneling under trees may be accomplished by one of the following:
   1. Boring and jacking casing pipe along with placement of a carrier pipe.
   2. Boring and jacking of sewer pipe or water main without a casing pipe.
   3. Jacking sewer or water main without boring and without a casing pipe.

D. Plan notes or existing field conditions shall indicate which method may be used for the tree tunneling work.

3.18 BEDDING

A. Bedding shall be worked under the haunches of the pipe to provide firm, continuous support.

B. Material shall be placed and compacted on the sides and above the pipe in accordance with the "Initial Backfill" paragraph below.

3.19 BACKFILL

A. Place and compact backfill in excavations promply, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.

4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring and bracing, and sheeting.

B. Place backfill on subgrades free of mud, frost, snow, or ice. No sloppy or wet material shall be used as backfill.

C. Contractor shall backfill trenches and other excavations with suitable excavated material or granular material as specified in this section.

D. Initial Backfill (up to 12" over pipe) shall be compacted granular backfill for pipes less than 36 inches in diameter. Bedding and backfill of pipes 36 inches in diameter or greater shall be pea gravel up to the spring line of the pipe and compacted granular backfill from the spring line up to 12 inches above the pipe.

E. Final backfill (greater than 12" above pipe):
1. Final backfill shall be compacted granular backfill unless otherwise noted in the project plans and details. Final backfill material shall be placed in layers not to exceed 12 inches thick unless the Contractor can demonstrate to the satisfaction of the Owner's Representative that he can consistently attain the specified density at all depths on thicker lifts.
2. If the moisture content of job excavated cohesive backfill material exceeds the optimum moisture content for maximum density by more than three percent (3%), the Contractor shall dry the material to meet the foregoing moisture content limitation or provide, at his own expense, approved granular backfill.
3. Each lift of final backfill, granular material and job excavated backfill, shall be compacted by the contractor to 95% of maximum unit weight, as verified in accordance with the "Density Testing of Backfill" paragraph below. Additional lifts of backfill shall not be placed until acceptable compaction has been achieved and verified on the underlying lift.
4. Wherever gas mains, water mains, sewers, or other utilities are located in the trench area, granular backfill shall be used for backfill from bottom of the trench up to the spring line of the highest pipe. Granular backfill shall be placed across the full trench width and extend far enough either side of the existing pipe to allow specified compaction so as to thoroughly support the pipe within the trench area.

F. Maximum unit weight will be determined by ASTM D 1557, current methods of Test for Compaction and Density of Soil, AASHTO Designation T-180 or by the Cone Density Method developed by MDOT, as directed by the Owner or Owner's Representative.

G. When job excavated backfill and/or compaction methods are not suitable to obtain the specified compaction, the Contractor shall, at his expense, remove unsuitable materials or add granular materials, or both, to obtain compaction as specified.

H. Any depression resulting from settlement of any backfill prior to the date of final payment for all work under this contract shall be brought to the proper grade and surface and made to match the adjacent surface. Any additional surface restoration, re-pavement, utility repair, and/or landscaping repairs required as a result of settlement shall be performed in accordance with the relevant Section at the Contractor's expense.

I. Compaction:
1. Initial backfill of pipes (up to 12" over pipe) shall be compacted with a hand tamper, walk-behind vibratory compactor or equivalent equipment.
2. Compaction of Final backfill shall be obtained with the use of a bulldozer, sheepsfoot roller, mechanical tamper, excavator mounted compactor, or other similar and effective

equipment. Compaction shall be performed by the contractor at his expense, in order to satisfy the density requirements of this contract.

3. Materials identified on the plans as “CIP” or “Compacted” shall be compacted in this manner and to the requirements of this section.

J. Density Testing of Backfill

1. Density of compacted final backfill shall be verified in-place by the Owner’s Representative in accordance with ASTM D 6938 (nuclear gauge).
2. The Contractor shall be informed of all density test results as they are recorded.
3. Contractor is responsible for providing and maintaining safe and reasonable access for a field engineer or technician to verify the compaction of each lift in the trench.

K. Trenches in Pavement Areas

1. Final backfill shall be granular backfill for all trenches under proposed or existing paved streets, shoulders, traveled roadways, parking areas and driveways as shown on the plans up to the required surface subgrade elevation which will allow for placement of the required gravel base and/or pavement surface. With the approval of the Owner’s Representative, water jetting may be accepted in lieu of tamping for granular backfill only.
2. Final backfill shall be compacted granular backfill for the entire trench when either edge of trench is within three (3) feet of proposed or existing edge of pavement. On road crossings, specified compaction shall extend ten (10) feet beyond the edge of pavement for paved roadways with gravel shoulders or shall extend three (3) feet beyond the back of curb for roadways with curb.
3. Trenches under proposed or existing concrete sidewalks and bike paths shall be backfilled from one foot above top of pipe to a level four (4) inches below finished grade of the sidewalk with approved suitable excavated backfill or granular backfill and compacted to ninety-five percent (95%) maximum density.

L. Backfilling Around Structures

1. As soon as practicable after concrete structures have set, forms and debris shall be removed and the surface of the concrete pointed. After the structure has been checked and approved, the excavated area around the structure shall be backfilled up to specified subgrade with granular material or suitable excavated material as called for on the drawings for the adjacent trench. The fill shall be thoroughly compacted by machine tamping. No large boulders or ma-sonry shall be placed in backfill. No backfill will be placed against manhole walls within 48 hours after the plaster coat has been applied to the outside of the walls nor shall backfill be placed about concrete structures until concrete has attained at least 75 percent of its design strength and approval of the Engineer has been obtained.

3.20 WARNING TAPE INSTALLATION

A. Contractor shall place warning tape directly over all lengths of pipe, between lifts of final backfill a minimum of 12 inches above the top of the pipe and no less than 12 inches from the finish grade of the trench, as directed by the Owner’s Representative or the plans.

3.21 REMOVAL AND TRANSPORT OF EXCAVATED MATERIAL

A. Excess suitable material and unsuitable material that remains after trenching and backfill activities shall be handled and disposed of in accordance with the Division 31 Section regarding “EARTH MOVING”

3.22 FINISH GRADE OF TRENCH

3.23 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified geotechnical testing agency to perform the following special inspections:
   1. Determine that backfill material and maximum lift thickness comply with requirements.
   2. Determine, at the required frequency, that in-place density of compacted fill complies with requirements.

B. Contractor shall allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent trenching and backfilling only after test results for previously completed work comply with requirements.

C. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained. Material shall be replaced at the cost of the contractor if repeated tests of backfill are not verified as acceptable to the testing agency.

3.24 CONTRACTOR SAFETY REQUIREMENTS

A. The excavation and trenching operations shall be conducted by the Contractor in a manner that will provide safe working conditions for all persons on the site who may be affected by the Work. The Contractor shall also conduct his operations in a manner that will protect adjacent property from damage.

B. Trench sides shall be either cut back to the slope as necessitated by soil and ground water conditions to provide stable sides, or supporting systems shall be installed that are capable of restraining the earth sides from movement. A qualified employee of the Contractor shall design the trench supporting systems.

C. The Contractor shall employ, at all times at the site of the work, a qualified person who will be responsible for the safety of both the work and workmen, and who will make all the decisions relevant to the stability of trenches, the adequacy of any and all protective devices, proper operation of equipment, and all other matters related to safety.

D. The Contractor shall not store, along and adjacent to the trench, excavated material, heavy equipment, backfill materials, sewer pipe, or other construction materials which may impose too great a load on the earth and cause displacement or caving of the earth. The Contractor shall, at all times, provide a safe means of emergency exit from all trench excavations.

END OF SECTION 312333

CITY OF OWOSSO

SPECIAL PROVISION
FOR
WATER MAIN INSTALLATION

DESCRIPTION

This work shall consist of installing water main and appurtenances in accordance with the plans, this special provision, AWWA, MDEQ, and the MDOT 2012 Standard Plans and Specifications. This shall include all labor, equipment, and materials to complete the work.

For the protection of underground utilities and in conformance with Public Act 174 of 2013, the Contractor shall contract the Miss Dig system, Inc. by phone at 811 or 800-482-7171 or via the web at either elocate.missdig.org for single address or rte.missdig.org, a minimum of 3 business days prior to excavation, excluding weekends and holidays.

The Department of Public Works can assist the Contractor in locating existing water service leads and mains. All removed valves and hydrants shall be salvaged and returned to the Department of Public Works.

The Contractor shall contact the Engineer to schedule work interfering with existing water service. Temporary shut off of service shall be obtained from the Department of Public Services.

A service charge of $1,000 will be required at time of permit application. This fee includes the minimum charge of $50 for 5,000 bulk gallons of water, plus additional charges of $10 per 1,000 gallons consumed in excess of the minimum quantity. Owosso Water System personnel will attach a water meter and RPZ backflow preventer to the hydrant for Contractor use. If the water meter and RPZ is returned in good operating condition, the Contractor will receive a $450 refund, less additional water consumed in excess of minimum quantity.

MATERIALS

All materials supplied by the Contractor shall be new, meeting minimum specifications of American Water Works Association (AWWA) Standards, and special provisions as delineated by the City of Owosso. All materials shall be lead free as defined by the USEPA Safe Drinking Water Act, in that; “All pipes, pipe fittings, plumbing fittings, and fixtures that are used for potable water must comply with the lead free requirement and must bear the mark NSF/ANSI Standard 61, Annex G or NSF 61-G.”

Michigan and United States of America products shall be used whenever possible.

Pipe

Water main constructed of PVC pipe shall conform to AWWA C900/C909 standards. C909 PVC pipe shall be used for open trench cut installations. C900 PVC fused pipe shall be used for

trenchless installations. Pipe shall meet both NSF/ANSI Standard 61 and NSF/ANSI Standard 14. PVC pipe shall have a ratio of diameter to wall thickness of 18, unless noted otherwise on the plans or in the proposal.

Water main constructed of ductile iron pipe shall conform to AWWA C151/C600. Pipe shall meet Thickness Class 52 and Pressure Class 350. Ductile iron pipe shall be lined with a cement mortar and bituminous seal coat in accordance with AWWA C104.

Pipe manufacturer and class shall be marked on each length of pipe.

Pipe, fittings, joints, and fire hydrants in soils contaminated with volatile organic compounds, as determined in the field by the Engineer, shall require the use of Linear Low Density Polyethylene black (8-mil) Poly Wrap ANSI/AWWA C105/A21.5, ASTM D882, for up to one foot of finished grade.

Fittings/Joints

Joints shall be push-on type with elastomeric gaskets meeting the requirements of ASTM D3139/ F477 or AWWA C111 and shall be provided with an electrical conductivity device.

Fittings shall be cast iron or ductile iron with mechanical joints and shall be in accordance with AWWA C153 / ANSI A21.53. Fittings shall be cement lined in accordance with ANSI/AWWA A21.4/C104 and rated for 250 psi, or more.

Following manufacturer's standards, mechanical joint restraint shall be required and shall be MEGALUG by EBAA Iron, or approved equal.

All mechanical joints and fittings requiring bolt-on fasteners shall use Blue Core Bolts.

Corrosion protective material as a barrier encasement in varying soil conditions shall be required. Use 1) Linear Low Density Polyethylene black (8-mil) Poly Wrap ANSI/AWWA C105/A21.5 ASTM D882, or 2) Sanchem, Inc. NO-OXG-ID GG-2 lubricant. Corotech coal tar epoxy is not permitted for use.

Ductile iron water main shall require the use of nitrile gaskets, and used in place of PVC pipe where hazardous soils exist..

Fire Hydrants

This item shall include the fire hydrant, an auxiliary valve (placed 3 feet from hydrant), valve box, connector pieces and the hydrant tee. These items shall be installed in accordance with the standard construction practices and the standard fire hydrant detail. Bends approved by Engineer

and Department of Public Works may be added into the connection, but shall not be paid for separately. Extensions will also not be paid for separately.

All fire hydrants shall be manufacturer by East Jordan Iron Works (**EJIW) Stortz** 5BR250, 55726D, open right, with 5 1/2 foot depth of bury, and painted yellow, and manufactured in accordance with AWWA C502 specifications. Hydrants shall be provided as outlined in the details within the construction plans and below:

1. Dry-barrel fire hydrant traffic model or traffic flange type and 150 pound working pressure, compression type, and opening with the line pressure, with mechanical joints.
2. Fire hydrants shall be bronze mounted throughout with no iron-to-iron or steel contacts or threads. The operating stem in the base and valve seat shall be bronze.
3. All iron parts shall be of high strength grey iron conforming ASTM A126 Class B.
4. Fire hydrants shall have a 6-inch valve opening with a 6-inch mechanical joint inlet.
5. The minimum inside dimension shall be 8 inches.
6. The operating nut shall turn to the right to open and have a weather shield. The opening direction shall be plainly marked with an arrow near the operating nut showing the opening direction.
7. The operating nuts and nut nozzle caps shall be square and slightly tapered; and it shall be $^{15}/_{16}$" at its base and $^{13}/_{16}$" square at its end and 1- $^{1}/_{8}$" long.
8. Fire hydrants shall be completely assembled at the factory with the drain opening sealed with a threaded plug.
9. Provide two fire hose connections and one pumper connection in accordance with municipality standards.
10. All nozzles shall be on a movable head on the hydrant barrel so that they may be rotated by changing the position of the top flange without removing the barrel.
11. Provide a Spring Cap Style McGard Fire Hydrant Lock for hydrant.
12. Provide proper length for installation at water main depth as indicated on the drawings.
13. All township fire hydrants (optional for in City of Owosso) shall have a concrete collar around the lower barrel, 12" below the ground line with 1" of expansion joint material between the hydrant barrel and collar, as directed by the Engineer. The collar shall be 6 inches thick with a diameter of at least 24 inches. Diameter will be as wide as necessary to reach undisturbed earth. Fire hydrants shall be tested to 300 pounds hydrostatic pressure from inlet side with valve in both open and closed position.
14. Fire hydrants to be painted yellow above the grade line, and black below the grade line. The 5" cap to be painted to AWWA color code based on municipal GPM flow data.
15. Fire hydrants shall be designed so one man can easily remove or replace the working parts without removing the main valve seat.
16. Fire hydrants flags are optional, and only upon request of municipality.
17. Hydrant valve operating nut shall be 2-inch.
18. Hydrant lead shall be six (6) inch with MEGALUG mechanical joint restraint.

Gate Valves & Boxes

All gate valves shall be manufactured by East Jordan Iron Works (EJIW). All valves for use in water distribution systems shall be resilient seat, single wedge valves. The valves shall be in accordance with AWWA Specification C515 and shall also meet any supplemental requirements

or specifications of the municipality. Valves used on this project shall have mechanical joints with stainless steel bolts. The valves shall be manually operated with non-rising stems, iron body, bronze trim, and be furnished with a standard AWWA 2 inch square-operating nut. The wrench nut shall turn right (clockwise) to open with red top and shall be indicated by an arrow cast on the operating nut skirt. Valve stem risers are required for depths greater than 6'-6" and will not be paid for separately.

All valve boxes shall be manufactured by EJIW**.** The valve box shall be cast iron, 5-½ inch diameter, and three-piece adjustable screw type. Valve box extensions are required for depths greater than 6'-6" and will not be paid for separately. No. 6 round bases are required for gate valves up 8" in diameter and No. 160 oval bases for gate valves 10" and greater. The drop covers shall be stamped "water".

Curb Stops/Boxes, Taps, and Services

The water service piping shall be copper tubing, Type K, annealed, in accordance with ASTM B88. The size of tubing shall match the existing size of the water service being replaced. The fittings shall conform to ASTM B16.26, cast bronze. Joints of the copper tubing shall be flared. All water services to be constructed 90 degrees from water main to curb-stop/meter pit.

Taps – Ductile Iron Pipe:

1. For ¾ inch residential service tap, no saddle required. Use Ford F-1000-3-Q-NL, taped thread x CTS – QJ (Note: 1-inch minimum now required)
2. For 1 inch residential service tap, no saddle required. Use Ford #F-1000-4-Q-NL
3. For larger than 1 inch service tap, use Ford #F series as appropriate.

Taps – PVC Pipe:

1. Use Power Seal stainless steel saddle Model 3417AS for 4" to 24" diameter pipe.

Curb stops/boxes shall follow below:

1. Curb Stops shall be manufactured by Ford, Model #B-44-333-Q-NL for ¾ inch ball-stop, and Model #B-44-444-Q-NL for 1 inch ball-stop. Female thread x CTS – QJ or CTS – QJ x CTS – QJ.

2. Curb Stops shall be 5’ 6” deep.
3. Curb Stop Boxes shall be the Standard Buffalo patterns and all parts of the same, including extension sections, shall be interchangeable and fit up with corresponding parts of other Standard Buffalo pattern boxes.
4. Internal diameter of base shaft shall be 2-1/2 inches for (3/4 inch and 1 inch curb stop).
5. The boxes shall be cast iron, suitable coated to resist corrosion and the casting shall be smooth and free of any imperfections.
6. The covers shall overlap and fit outside the rim of the upper section, and they shall have a horseshoe-shaped groove in them to receive the bolt head and the word “water” embossed on the top surface.
7. All boxes shall be Tyler 6500 (2-1/2” Boxes) Series.

Tracer Wire and Boxes

Tracer wire shall be #10 AWG polyethylene coated steel core copper wire, attached to pipe by tape or other approved means, and manufactured by Copperhead Industries, LLC – Copperhead Reinforced Tracer Wire, or equal. Tracer wire connectors must contain a dielectric waterproof and corrosion proof sealant, lock shut, and be color coded blue. (See MRWA Detail as Attached)

Tracer wire boxes shall be magnetized, with a direct connection to tracer wire without removing the cover, be color coded, and have a locking cover. Boxes shall be installed at every fire hydrant isolation valve (separate from the valve riser), and at every distribution water main isolation valve (separate from the valve riser) and shall be Copperhead Industries, LLC – Snake-Pit Magnetized Tracer Box, or equal.

CONSTRUCTION METHODS

Excavation

The Contractor shall excavate all material to the depths necessary to construct the water main as shown on the plans. Excavation shall include the removal of rock, dirt, abandoned pipelines, old foundations, stumps and roots and similar materials encountered. Excavation, of whatever material encountered, shall be included in the contract unit prices for water main installation and will not be paid for separately. All excavated material shall be contractor responsibility for removal and disposal. Pavement removal and restoration will be paid for at the contract unit prices for the appropriate item in accordance with the Standard Specifications and Supplemental Specifications.

Excavated material that is suitable for backfill material shall be neatly piled adjacent to the excavation so as to prevent cave-ins of the excavation and damage to adjacent trees, shrubs, fences, and other property.

The excavated area shall be kept free of water at all times. Sheeting and shoring shall be provided if necessary for the protection of the workers.

Excavated material that is not to be used as backfill shall be disposed of by the Contractor.

Backfilling shall follow immediately behind trench excavation and pipe laying operations. In no case shall more than 100 ft. of trench excavation be open at any one time. Any excavation left open and unattended shall be protected with lighted Type III barricades and a "snow fence" constructed around the perimeter of the excavation.

The Contractor shall excavate to the depths required to construct the water main and appurtenances as described on the plans. For water main construction, trench excavation shall be to a depth sufficient to provide a 5' 6” cover over the top of the pipe and a minimum four-inch sand cushion below the pipe. Over excavation will be at the Contractor's expense. The trench width at a level of twelve inches above the pipe shall be a minimum of 36 inches in width or as directed by the Director of Public Services or his designee.

In areas where the proposed construction may interfere with existing utilities, additional excavation may be required to determine the exact location of said existing utilities. This work will be included within the water main pay items and no additional compensation will be due to the Contractor for this work.

In some cases, the plans call for removing an existing water main or sewer in order to construct a new water main. All gate valve boxes shall be removed to at least 3 feet below the pavement surface under the road and to at least 12 inches below the planned grade outside the road. When required by construction specifications, the Contractor shall remove said existing pipelines and gate valve boxes and dispose of them at his expense. Old gate valves pulled by Contractor shall be turned over to the City of Owosso for further disposition.

Abandoned Water Mains. Where abandoned in place/ground, open ends of an abandoned pipeline shall be capped with a metallic cap, flowable filled, and bulk headed with one course of brick and mortar. Removal, disposal, flowable filling, and bulk heading of pipelines to be abandoned are included in Cut and Plug Water Main pay item. The following exceptions apply:

- 4 inch abandoned mains not required for flowable filling material.
- 6 inch and larger abandoned mains will be priced out by Contractor for flowable filling material. Only the city of Owosso may waive flowable flow material requirement.

Abandoned Water Service Connections. Services no longer in use shall be abandoned at the curb-stop, with curb-stop in off position and buried. However, during street construction, abandoned services shall be removed back to the water main, with the corporation in the off position and capped, or the corporation removed entirely and replaced with a repair clamp.

Pipe Handling

Pipe shall be handled in such a manner as to prevent the ends from splitting, damages to the protective coatings, and other undesirable conditions. Pipe shall not be dropped, skidded, or rolled into other conditions. Repairs to damaged pipe must be approved by the City Engineer or authorized representative.

Pipe Cutting

Pipe cutting shall be done in a neat and workmanlike manner without damage to the pipe or lining and as to leave a smooth end at right angles to the axis of the pipe. Cutting shall be done by an approved mechanical saw or cutter. Hydraulic squeeze cutters are not acceptable.

Pipe laying

Pipe located inside structures shall be rigidly supported.

Pipe laid underground shall be uniformly supported through its entire length on a minimum four-inch cushion of sand. A depression shall be carved out of the sand cushion to accommodate the pipe bells.

Pipe laid at a depth with less than 5 1/2 foot of cover, shall be wrapped in Linear Low Density Polyethylene black (8-mil) Poly Wrap ANSI/AWWA C105/A21.5 ASTM D882, and encased with minimum 2-inch thick rigid Styrofoam board top and sides of pipe.

Pipe shall be inspected for defects, debris, or dirt while suspended in a sling prior to lowering it into the trench. Defective pipe shall be removed from the project site immediately. Lumps, blisters, and excess coal tar coating shall be removed from inside the bell and outside the spigot. These areas shall be wire brushed and wiped clean with a dry oil-free rag. No debris, tools, clothing, or other materials shall be allowed in the pipe.

Pipe shall be laid in a dry trench with bell ends facing in the direction of laying. After placing a length of pipe in the trench, and after installing the gasket and applying the gasket lubricant, the spigot end shall be centered in the bell and the pipe pushed home and brought to the correct line and grade. The pipe shall be secured in place by tamping granular material Class II around it. Precautions shall be taken to prevent dirt from entering the joint space. A watertight plug shall be inserted in the open end(s) of the pipe to prevent water, dirt, animals, or other foreign matter from entering the pipe.

When it is necessary to deflect pipe from a straight line, either horizontally or vertically, the deflection shall not exceed the following values:

Nominal Pipe Size (In.)	Mechanical Joint Maximum Deflection (In./18 ft. length
8	20
12	18

Jointing

Mechanical joints shall be installed in accordance with the joint manufacturer's recommendations. Copies of such recommendations shall be furnished to the Engineer prior to the start of construction.

Thrust Blocking

Thrust blocking shall be placed to support water main components as follows:

- at Tee's
- at 90 degree bends
- at dead end water mains

Backfilling

Backfilling shall be in accordance with the trench detail called for on the plans or as directed by the Engineer in accordance with the following:

Trench Detail G shall be used when part of the trench is within the 1 on 1 influence area of an existing or proposed roadway, sidewalk, driveway, building (or similar structure), or located within the right of way. The trench shall be backfilled with granular material Class II, in lifts of ten inches, and mechanically tamped to 95% of maximum unit weight.

Trench Detail F shall be used when the trench is not within the 1 on 1 influence area of a road or structure. The trench shall be backfilled with granular material Class III to a level of six inches above the top of the pipe and compacted to not less than 95% of maximum weight. The remaining portion of the trench shall be backfilled in twelve-inch lifts with suitable excavated material and compacted to at least 90% of maximum unit weight. Suitable excavated material used for backfill shall be free of rocks, debris, trees, stumps, broken concrete, and organic material. Backfill material shall not be saturated with water.

Where the proposed water main crosses under an existing utility, the proposed water main shall be deflected around the existing utility in accordance with the following:

1. Maintain 5' 6" cover over top of proposed water main.
2. Maintain at least 18" of vertical separation and 10' horizontal separation between the outside of the proposed water main and the outside of a sewer, drain pipe, or catch basin. Where less than 18 inches of vertical separation, encase water main in a concrete or plastic pipe. Where 10 LF of horizontal separation cannot be achieved, a variance shall be requested of the MDEQ/EGLE District Engineer.
3. Maintain at least one foot vertical separation between the outside of the proposed water main and all other utilities other than a sewer, storm drain, or catch basin.
4. When crossing an existing sewer, drain pipe, or catch basin lead, construct the proposed water main so that its joints are equidistant from the utility being crossed.
5. For carrier pipes less than six (6) inches in diameter, the inside diameter of the casing pipe shall be at least two (2) inches greater than the largest outside diameter of the carrier pipe joints or couplings. For carrier pipe six (6) inches or greater in diameter, the inside diameter of the casing pipe shall be at least four (4) inches greater than the largest outside diameter of the carrier pipe joints or couplings.
6. Centering devices shall be used when inserting the carrier pipe into the casing pipe.
7. All casing pipe ends that are below ground level shall be constructed as to prevent leakage of any substance from the casing throughout its length. Each end of the casing shall require a sufficient seal to prevent the potential for leakage of any substance from the casing pipe. Grout fill is an acceptable method installed by pressure grouting. If used, the grout material shall consist of non-shrink sand cement slurry or approved equal, and sufficiently seal the casing pipe ends to the satisfaction of the Engineer.

Hydrants

Hydrants shall be located as shown on the plans and approved by the municipality.
Use of bends in connection shall be approved by Engineer and municipality.
Bury depth shall be a 5 1/2 foot minimum. Six (6) inch hydrant leads shall be ductile iron with MEGALUG mechanical joint restraint.

Valves

Valves shall be located as shown on the plans and approved by the municipality. Valves placed in location without approval will require that the Contractor correct the error at his own expense.

Valve setting shall be examined by the Contractor prior to lowering in the trench. Check all nuts and bolts to assure tightness.

Valves shall be installed with the valve closed, supported on two 2" x 6" x 18" hardwood blocks, and vertically plumb. The valve box shall be set plumb and its axis shall be in line with the stem. Valve boxes shall have the ability for future adjustments of up to 6 inches, above or below grade.

Two isolation gate valves shall be installed at each 3-way intersection, and a three valve configuration at each 4-way intersection.

Isolation/gate valves should be located within each intersection for easy identification for the system operator. Spacing of these valves should be about 6 feet for quick and easy determination of directional isolation. As result, end points of new main/cross overs, shall be plugged, with a blow-off at each end point for appropriate disinfection & pressure testing. The new water main shall not be connected to the existing water main until pressure and disinfection testing has passed city requirements.

Reaction Backing

All tees and 90 degree bends, and other fittings subjected to unequal thrust shall be restrained using mechanical joint fittings with retainer glands on both sides of the bend or tee, and shall also be supported with thrust blocking. All 45 degree bends shall be restrained with mega lug fittings.

Boring and Jacking

1. Construct and maintain jacking/boring pits as required. Adequately clear site required for pits as needed to perform the work. Size pits for boring machine, frames, and reaction blocks, minimum 2 sections of pipe and with sufficient room for working. Provide steel safety ladder.
2. Locate pits such that no damage occurs to trees, poles (not specified for removal) or structures in the immediate area.
3. Construct pits with sheeting and bracing as required for proper support in accordance with O.S.H.A. Standards and as needed to sufficiently support reaction blocks.
4. Place crushed rock or approved bedding to sufficiently support equipment and protect pit floor.
5. A pushing or jacking frame shall be built and furnished to fit or match the end of the pipe to be jacked so that the pressure of the jacks will be evenly distributed over the end of the pipe.
6. The hydraulic jacks shall have sufficient power to apply a smooth and even pressure to move the pipe in place. Hammering or ramming of the pipe will not be allowed.
7. The pipe shall be jacked upgrade where possible.
8. The excavation shall be done within the inside of the pipe and shall not exceed 12” ahead of the pipe being jacked in place.
9. After each pipe section is in place the pipe shall be checked for correct grade and line. Pipe not meeting the correct grade and line shall be rejected and replaced.
10. Excavation at the top and sides may be approximately 1” greater than the outside periphery of the pipe.
11. The bottom of the excavation shall be accurately cut to line and grade.

12. Adjoining sections of pipe sleeve shall be attached with a continuous weld. Connecting steel pipe to concrete shall be completed with a poured in place concrete collar with reinforcement.

HYDROSTATIC PRESSURE TEST

All new construction shall be subjected to a hydrostatic pressure test. Testing should be performed as soon as possible after construction on a section is complete.

The Contractor shall provide all equipment, materials, and labor necessary to perform the tests, including pumps, gauges, plugs, corporations, excavation and backfill, water, miscellaneous piping and fittings, and a means of measuring the volume of water lost.

The Contractor shall fill the main with water through hydrants or corporations. Air shall be bled off at the ends and at highpoints through corporations or hydrants. The Contractor shall plug all taps made solely for the pressure test by inserting brass plugs.

Water shall be added until hydrostatic pressure at highest point of the main is at least 150 psig.

The Engineer shall be notified two hours prior to testing and shall witness the test and determine the leakage over a two hour period.

Water shall be added as necessary throughout the two hour test period to maintain a uniform pressure of 150 psi, plus or minus 5 psi.

At the end of the two hour period, the total volume of water added to maintain the required test pressure will be determined and will be the actual leakage in a two hour period.

The allowable leakage rate will be determined by the following formula:

$$L = \frac{S*D*((P)\text{^}1/2)}{148{,}000}$$

Where:

L = Total allowable leakage rate (gal/hr).
S = **Total length of pipe tested, in feet.**
D = Nominal inside pipe diameter (inches).
P = Actual test pressure (p.s.i.g).
^1/2 = Square Root of P

Maximum leakage for 8 inch pipe = 1.3 gallons per two hours per 100 joints.

If actual leakage rate exceeds the allowable leakage rate, the Contractor at his own expense shall locate and repair the leak(s). Testing shall be repeated until satisfactory results are obtained.

The cost of pressure testing shall be included in the pay item for Water Main Pipe actually constructed.

STERILIZATION

General

1. All pipe and fittings connected to and forming a part of a potable water supply shall be sterilized in accordance with the AWWA Standard C651-14.

2. Generally, sampling taps shall be provided on the water main every five hundred (500) feet, in order to afford representative water testing and sample collection. When long transmission mains are constructed, without side connections, the distance between each tap may, at the discretion of the Engineer, be increased. In addition, blow off connections and sampling taps shall be provided at every endpoint of the water main to be tested. No connection to the existing potable water system will be allowed until the new water main is approved. In all instances, sampling taps shall be provided to collect a source sample and enough representative water samples for laboratory examination.

Preliminary Flushing

The main shall be flushed prior to sterilization as thoroughly as possible with water pressure and outlets available. The main shall be flushed from the north gate valve first with the south gate valve closed, the north valve shall then be closed and the south valve opened. After the flushing is completed the plug for the 8 inch tee shall be installed. The minimum velocity in the main shall be 3.0 fps. The flushing operation shall be done after the pressure test has been made.

Disinfecting

1. Before being placed in service, all mains and existing piping disturbed in any manner by the work shall be disinfected in accordance with the AWWA Standard C651-14. Drawing the water from existing piping or even lowering the water pressure more than one-half will constitute disturbances of the piping.

2. The disinfecting of water mains, valves and other appurtenances incorporated into the main construction shall be done in accordance with the AWWA Standard C651-14.

3. During the disinfecting operation, valves, hydrants and other mechanical devices controlling the water shall be operated to permit full effectiveness of the disinfectant. Valves shall be manipulated so that the strong solution within the main being sterilized will not flow back into the supply line nor flow into mains already in service.

4. Dechlorination of chlorinated waters to surface water, storm sewer, or drain from hydrostatic testing and disinfection of new water mains, will be required prior to discharge unless discharged to a sanitary sewer system. ANSI/AWWA 655 Field Dechlorination provides methods and procedures for dechlorination of chlorinated water discharges.

Final Flushing and Tests

1. After the required period of retention has elapsed, the heavily chlorinated water shall be flushed out completely discharged until the replacement water throughout the length of the main shall, upon test, be proven comparable in quality to the water supply source. Heavy chlorinated water shall be discharged to a nearby sanitary sewer manhole if available, or a contractor provided holding tank for proper disposal.

2. When the water in the treated main shall have been proven comparable to that of the source, at least 2 safe bacteriological samples collected at least 24 hours apart must be obtained from every 500 feet sections of WM, must be obtained before placing each section WM section in service. . In addition, blow off connections and sampling taps shall be provided at every endpoint of the water main to be tested. No connection to the existing potable water system will be allowed until the new water main is approved. Samples shall be taken in the presence of the Department of Public Services. Under no circumstances shall such samples be collected from unsterilized hydrants and hose connections. Should the results of the bacteriological examination prove satisfactory, the main shall be placed in service. Should the initial disinfecting fail to result in approval, the disinfecting procedure shall be repeated until satisfactory results are obtained.

3. Bacteriological samples must be picked up by the **City of Owosso** and forwarded to an approved commercial/state/municipal laboratory, and paid by the Contractor. The City of Owosso may offer to provide this service with existing laboratory facilities.

The completed work of water main installation will be paid for at the contract unit prices for the actual quantity of the following contract items (pay items) actually constructed.

PAY ITEMS	PAY UNIT
1 inch Copper Service Lead, Type “K”, Modified	Feet
Water Main, C909 PVC, 12 inch, **TB Detail** F, Modified	Feet
Water Main, C909 PVC, 12 inch, **TB Detail** G, Modified	Feet
Water Main, C909 PVC, 8 inch, **TB Detail** G, Modified	Feet
Water Main, DI, 12 inch, **TB Detail** F, Modified	Feet
Water Main, DI, 12 inch, **TB Detail** G, Modified	Feet

Water Main, DI, 8 inch, **TB Detail** G, Modified	Feet
Water Main, Rem	Feet
Connect to Existing Water Main	Each
Curb Box, Stop, ¾ inch Corporation Stop and Connection, Modified	Each
Fire Hydrant and Valve Assembly	Each
Gate Valve and Box, 12 inch, Modified	Each
Gate Valve and Box, 8 inch, Modified	Each
Hydrant, Rem	Each
Water Main, 4 inch, Cut and Plug, Modified	Each
Water Main, 6 inch, Cut and Plug, Modified	Each
Water Main, 8 inch, Cut and Plug, Modified	Each
Testing and Chlorination of Water Main	Lump Sum

Water main will be paid for at the contract unit price for the actual length of water main installed in-place, for the various sizes and trench details called for. The contract unit price includes all labor, equipment, and materials necessary for the construction of the water main, including excavation, disposal, pipe, fittings, tees, crosses, hydrant tees, bends, plugs, reducers, thrust blocking, connections to the existing mains, backfill, snow fencing and barricading, locating and protecting existing utilities, repair of defective work, and cleanup.

Water main will be measured horizontally in linear feet along the centerline of the main, including the length of valves, sleeves, and fittings. Measurements will begin and end at connections, plugs, or the centerline of a perpendicular pipeline.

Testing and Chlorination will be paid for at the contract price upon completion and acceptance of the proposed water main and all tie ins. The contract unit price includes all labor, equipment, and materials necessary for hydrostatic pressure testing, disinfecting, and bacteriological testing of the proposed water main and appurtenances.

Connections to Existing Water Main will be paid for at the contract unit price for each connection made. Payment will include all labor, equipment, and materials necessary to connect the proposed water main to existing water mains, including connections to oversized and undersized pipe. Additional payment will not be made for any/all necessary coordination with the Department of Public Services or any exploratory excavation that is required to connect the proposed water main to the existing water mains.

Fire hydrant and valve assembly with box will be paid for at the contract unit price for each assembly installed. Payment will include furnishing and installing the hydrant, valve, valve box, connection, and lead. Excavation, thrust blocking, and backfill are all incidental to the contract unit price for hydrant and valve assembly with box.

Gate valves, of the size required will be paid for at the contract unit price for each installed. The price includes excavation, installation of manhole or box, removal of valve and box to be replaced, anchorage, and backfill.

Cutting and Plugging of Water Main will be paid for at the contract unit price for each cut and plug made and flowable fill. Payment will include all labor, equipment, and materials necessary to shore up the existing water main.

Glenn M. Chinavare
Director of Public Services & Utilities

Effective: 31 January 2018

Last update 30 October 2019

TYPICAL VERTICAL
IN LINE METER DETAIL

NOT TO SCALE

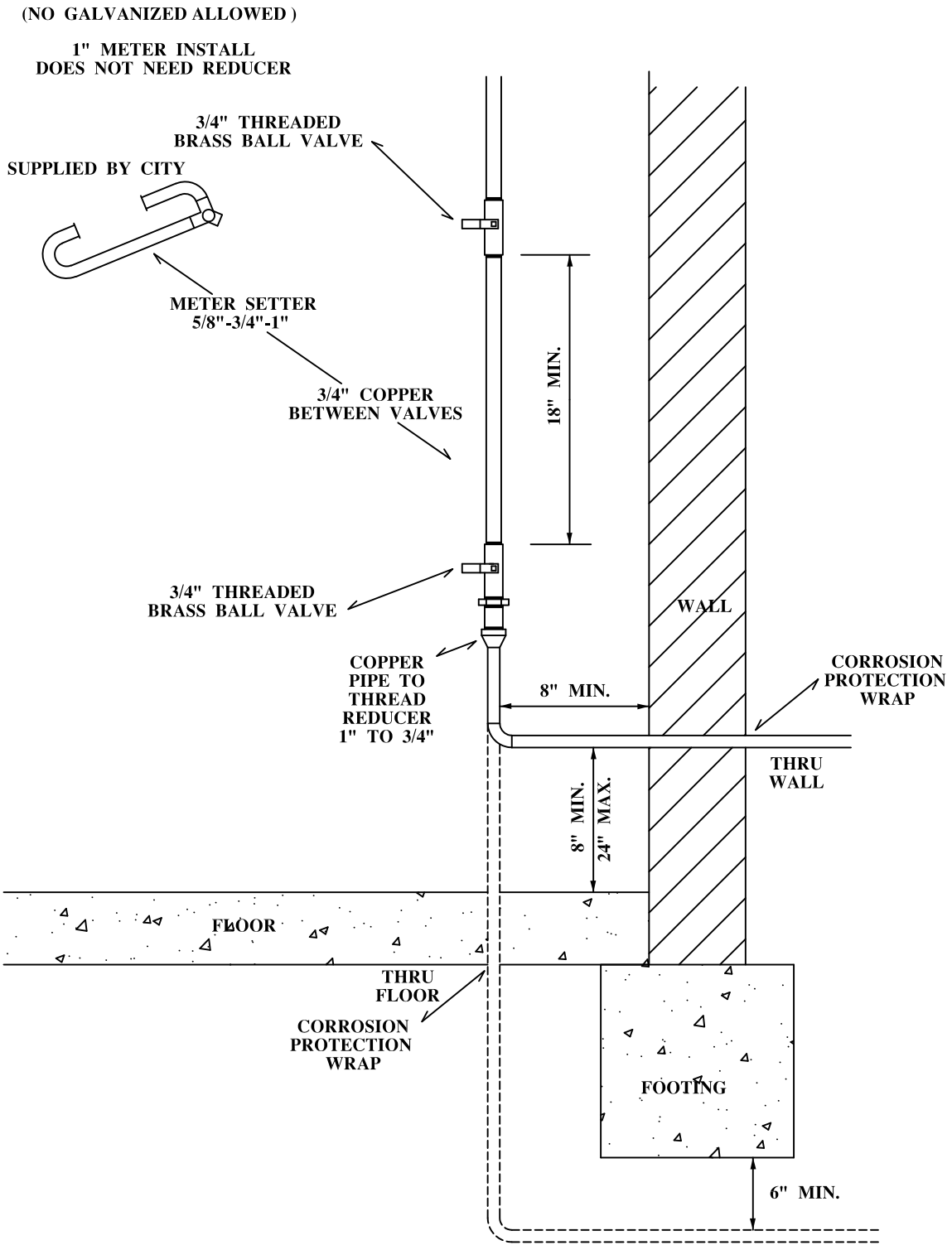


FIGURE 1b

RESIDENTIAL 1" WATER SERVICE FOR 5/8", 3/4", OR 1" METER

REVISED 1/2020

TYPICAL HORIZONTAL
IN LINE METER DETAIL

NOT TO SCALE

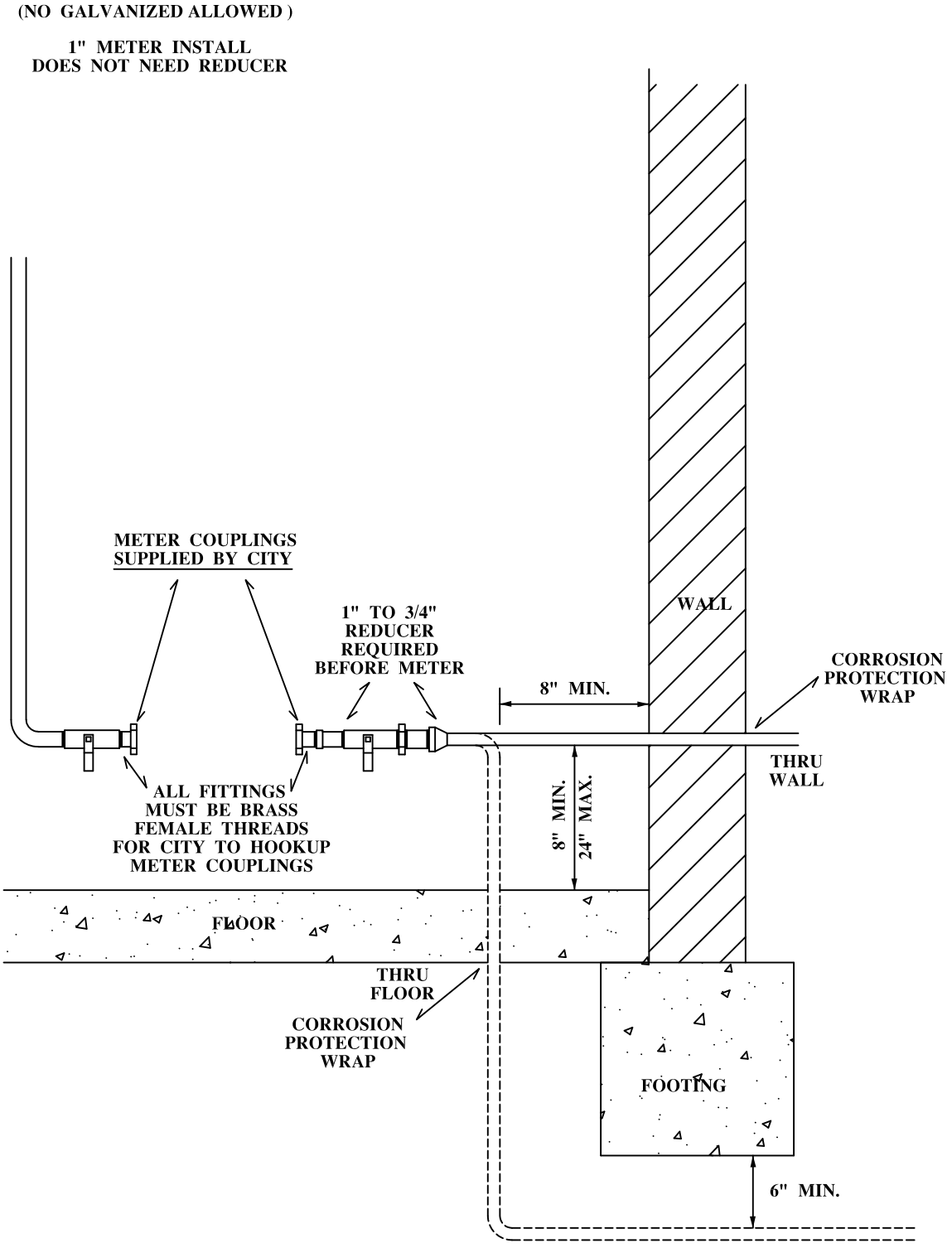


FIGURE 1a

RESIDENTIAL 1" WATER SERVICE FOR 5/8", 3/4", OR 1" METER

REVISED 1/2020

TYPICAL METER PIT DETAIL

NOT TO SCALE

1" COPPER: MAIN TO STOP 1" COOPER OR PEX: STOP TO HOUSE
(NO GALVANIZED ALLOWED)

FORD STOP

① **B-41-343-Q-NL 3/4" FEMALE x 1" CTS COMP**
71 SERIES

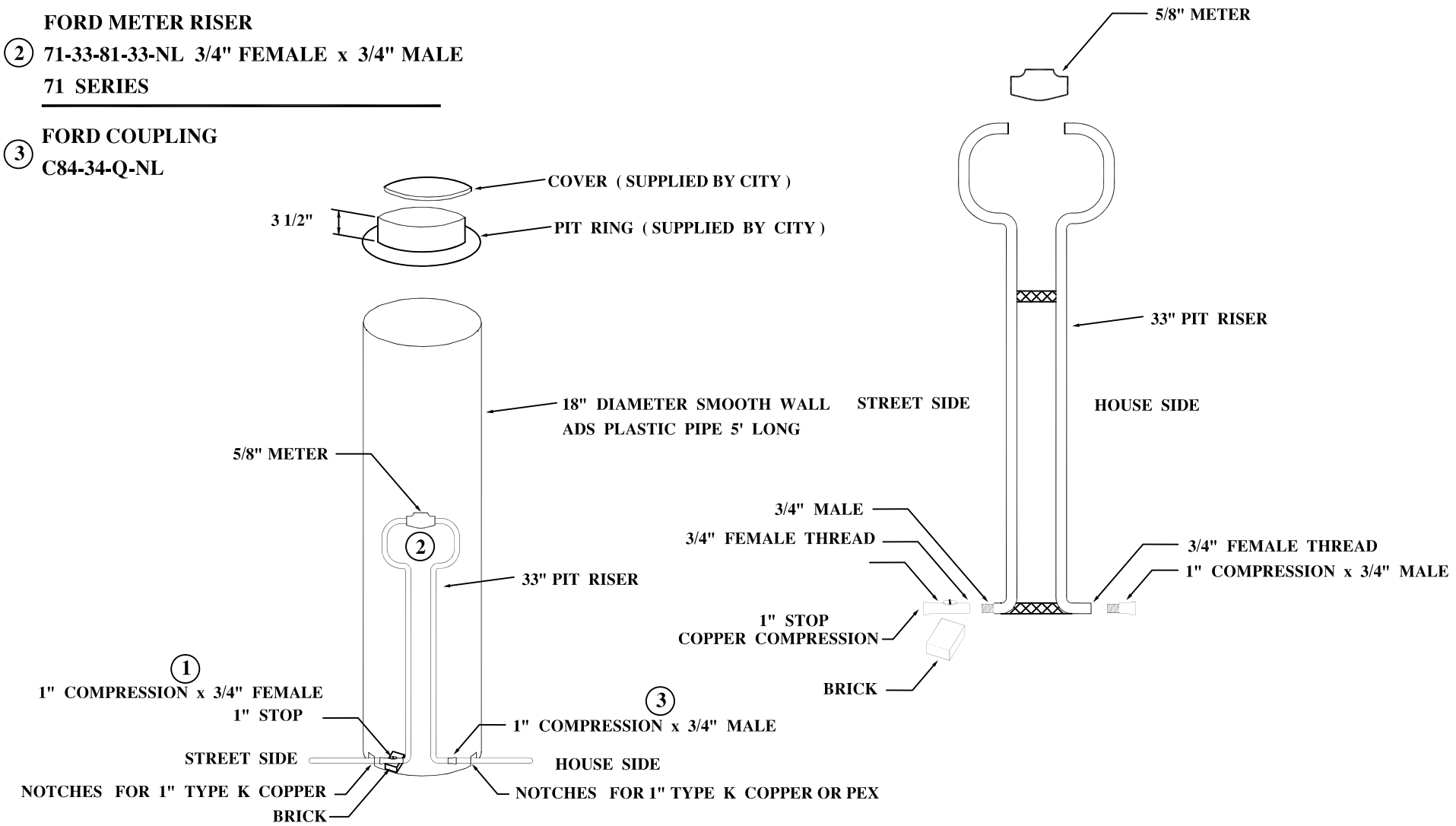
FORD METER RISER

② **71-33-81-33-NL 3/4" FEMALE x 3/4" MALE**
71 SERIES

FORD COUPLING

③ **C84-34-Q-NL**

DEQ
ALL PARTS MUST BE STAMPED
N L
FOR NO LEAD

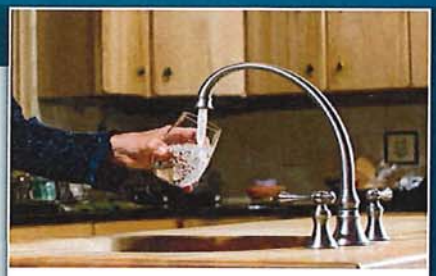


REVISED 1/2020

How to Identify Lead-Free Certification Marks for Drinking Water System & Plumbing Materials

What is the new lead-free requirement?

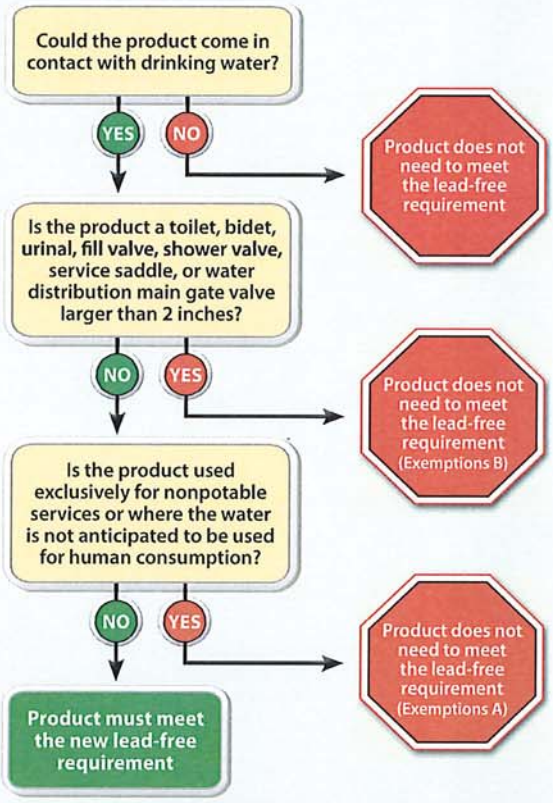
In 2011, the Reduction of Lead in Drinking Water Act was signed into law. The Act has reduced the lead content allowed in drinking water system and plumbing materials by changing the definition of **"lead-free"** in Section 1417 of the Safe Drinking Water Act. Although the law doesn't go into effect until January 4, 2014, some entities have been preparing for the change.



The term ***"lead-free"*** has been updated from not more than 8% lead content to mean ***"not more than a weighted average of 0.25% lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."***

How do I know which products must meet the new lead-free requirement?

Starting January 4, 2014, the prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. This includes coated or uncoated brass or bronze materials. By using the flowchart below as a guide, you can determine if a product must meet the new lead-free requirement:



Lead-Free Requirement Exemptions

(A) The new requirement does not apply to pipes, pipe fittings, plumbing fittings, or fixtures, including backflow preventers, that are used exclusively for **nonpotable services**, such as manufacturing, industrial processing, irrigation, outdoor watering, or any other uses where the water is not anticipated to be used for human consumption.

(B) The new requirement does not apply to toilets, bidets, urinals, fill valves, flushometer valves, tub fillers, shower valves, service saddles, or water distribution main gate valves 2 inches in diameter or larger.

Is lead-free certification required for products?

There is no mandatory federal requirement for product testing or third-party certification under the Safe Drinking Water Act; however, some entities may require certification.* Consumers can increase their level of confidence by purchasing products with a mark indicating that they have been certified by an accredited third-party certification body as meeting the new lead-free requirement.

Products that have not been certified may still meet the new lead-free requirement. If you are unable to determine if a product is lead-free, contacting the manufacturer is the best way to confirm the lead content.

**There are several states that have laws pertaining to the allowed lead content of pipes, pipe fittings, plumbing fittings, and fixtures, some of which require product certification. There may also be local laws or entities in other states that require it.*

How to identify products that are certified as lead-free

Next Page →

Disclaimer: This document is for informational purposes only. Any mention of trade names or commercial products does not constitute EPA endorsement or recommendation for use.

Who are the certification providers?

Although it is not a federal requirement, one way to ensure that a product is lead-free is to verify that it has been certified. In the United States, the following American National Standards Institute (ANSI) accredited third-party certification bodies provide product certification to the new lead-free requirement for manufacturers of drinking water system and plumbing materials:

- CSA Group
- ICC Evaluation Service (ICC-ES), LLC
- International Association of Plumbing and Mechanical Officials Research & Testing (IAPMO R&T)
- Intertek Testing Services NA, Inc.
- NSF International (NSF)
- Truesdail Laboratories, Inc.
- Underwriters Laboratories (UL), LLC
- Water Quality Association (WQA)

How do I know if a product has been certified?

Each of the ANSI accredited third-party certification bodies has a registered trademark that they use to certify a multitude of products for various requirements. However, the trademark alone does not necessarily mean that the product has been certified to the new lead-free requirement. Some of the certification bodies have modified marks and some may require that identifier text accompany a mark.

What do the lead-free certification marks look like?

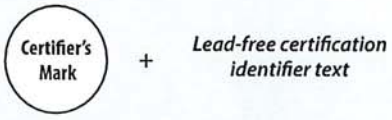
Because markings vary between certification bodies, finding a product that has been certified as lead-free to the new requirement can be a challenge—unless you know what to look for. The specific certification marks and identifier text for each certification body can be found in the comprehensive **Table on Page 3**, and can also be found for each certification body individually on **Pages A1–A8**.

Examples of the marks on packaging and engraved on a product can be seen in the photo strip to the right.

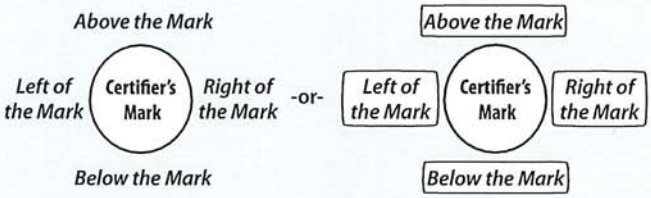
Where are the lead-free certification marks located?

Products will display the certification bodies' approved certification marks and any required identifier text. The following steps will help you to identify the variety of ways that both can be found on certified products:

1. The certifier's marks will typically be located on the front or back of the packaging or engraved on the product itself. If required, text for the lead-free certification identifier will also be included:



2. Next to the certifier's mark, the lead-free certification identifier text can stand alone or can be enclosed in a box:



Examples of packaging and material with certifiers' marks for the new requirement

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Certification Marks for

ANSI Accredited Third-Party Certification Bodies

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The table below provides the certification bodies' approved certification marks and required identifier text, as well as any additional remarks that indicate a product meets the new lead-free requirement.

"US" = United States; "USA" = United States of America; "C" = Canada; "CA" = Canada

Certification Body	Certification Mark(s)	Remarks & Required Identifier Text
CSA Group	LLC; Low Lead Content; NSF/ANSI 372; Drinking Water NSF/ANSI 61-G	**(1)** Based on the intended product market, the marks may be accompanied by a "C" & "US" or just a "US". **(2)** Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below table) must accompany the marks.
ICC Evaluation Services (ICC-ES), LLC	ICC ES PMG **LOW LEAD**	Text indicating certification to a lead-free certification identifier (listed in blue below table) may be included next to the mark, but is not required.
International Association of Plumbing and Mechanical Officials Research & Testing (IAPMO R&T)	UPC®; IAPMO R&T™; **UPC®**	**(1)** Based on the intended product market, the UPC shield and logo marks may be accompanied by a "C". **(2)** Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below table) or the term "Low-Lead" must accompany the marks.
Intertek Testing Services NA, Inc.	Intertek; Intertek	**(1)** Marks can be black or reversed in white. **(2)** Based on the intended product market, the marks may be accompanied by a "C"or a "US" or both. **(3)** Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below table) must accompany the marks.
NSF International (NSF)	NSF; NSF-61-G; NSF-372; NSF pw-G	**(1)** Marks can be blue, white, or black. **(2)** Based on the intended product market, the marks may be accompanied by a "C" & "US" or just a "C". **(3)** Text indicating certification to an NSF/ANSI Standard (listed in blue below table) must accompany circular marks. **(4)** Standard 61 circular and text marks may alternately include **"61/9-G"**.
Truesdail Laboratories, LLC		Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below table) must accompany the mark.
Underwriters Laboratories (UL), LLC	UL CERTIFIED HEALTH EFFECTS US CA File No.; UL; **UND. LAB. CLASSIFIED**; **UND. LAB. CLFD**	**(1)** Based on the intended product market, the marks may be accompanied by a "C", "CA", "US", "C" & US", or "CA" & "US". **(2)** Text indicating certification to an NSF/ANSI Standard (listed in blue below table) must accompany all the marks. **(3)** The File No. is a unique identification for a product used to search the UL online certification directory.
Water Quality Association (WQA)	TESTED AND CERTIFIED WaterQuality ASSOCIATION INDUSTRY STANDARDS; TESTED & CERTIFIED WQA INDEPENDENTLY; **NSF/ANSI 372 by WQA**	**(1)** The marks can be either gold or black and white. **(2)** Based on the intended product market, the Marks may be accompanied by a "C" & "USA" or just a "C". **(3)** Text indicating certification to an NSF/ANSI Standard (listed in blue below the table) must accompany the marks.

Lead-Free Certification Identifiers *(Varies between certification bodies. See the remarks column of table for clarification)*

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372): Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces. of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G): Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372 (Standard 61 text may alternately include "61/9-G").

California HB AB1953, Section 116875 (AB 1953 (2006) or CA HSC §116875 [AB 1953 (2006)]): Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

Resources and Contacts

EPA's Lead in Drinking Water Website
water.epa.gov/drink/info/lead/

Government Resources

Federal Laws
Reduction of Lead in Drinking Water Act (PL 111-380): www.gpo.gov/fdsys/pkg/PLAW-111publ380/pdf/PLAW-111publ380.pdf
Safe Drinking Water Act: water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm

State Laws
California AB1953: www.leginfo.ca.gov/pub/05-06/bill/asm/ab_1951-2000/ab_1953_bill_20060930_chaptered.html
California SB 1334: www.leginfo.ca.gov/pub/07-08/bill/sen/sb_1301-1350/sb_1334_bill_20080929_chaptered.html
Louisiana HB 471: legiscan.com/LA/text/HB471/id/343683
Maryland HB 372: 167.102.242.144/smb/mgaleg.maryland.gov/google_docs$/2010rs/chapters_noln/Ch_407_hb0372e.pdf
Vermont Statute, Title 9 V.S.A. § 2470h: www.leg.state.vt.us/statutes/fullsection.cfm?Title=09&Chapter=063&Section=02470h

ANSI Accredited Third-Party Certification Bodies

CSA Group
Low Lead Requirements: www.csagroup.org/us/en/industries/plumbing/low-lead-requirements
Certification Marks: www.csagroup.org/us/en/about-csa-group/certification-marks-labels
Certified Product Listings: www.csagroup.org/us/en/services/testing-and-certification/certified-product-listing

ICC Evaluation Services (ICC-ES), LLC
Listing Mark: www.icc-es-pmg.org/Mark/
Listing Directory: www.icc-es-pmg.org/Listing_Directory/

International Association of Plumbing and Mechanical Officials Research & Testing (IAPMO R&T)
Marks of Conformity: www.iapmort.org/Pages/MarksofConformity.aspx
Product Listing Directory: pld.iapmo.org/default.asp

Intertek Testing Services NA, Inc.
Mark Usage Guide: www.intertek.com/marks-usage
Product Directory: www.intertek.com/directories/

NSF International (NSF)
Low Lead Compliant Products and Markings: www.nsf.org/info/lowlead
FAQs about NSF/ANSI 61 and Lead, and NSF/ANSI 372: www.nsf.org/info/wdsfaq/
Product Listings: www.nsf.org/business/search_listings/

Truesdail Laboratories, LLC
Mark and Plumbing Listings: www.truesdail.com/specialty_testing/plumbing.html

Underwriters Laboratories (UL), LLC
Certification Marks and UL Badges: www.ul.com/global/eng/pages/corporate/aboutul/ulmarks/
Online Certifications Directory: database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html

Water Quality Association (WQA)
Use of the Gold Seal (Note - Click on download the Gold Seal Logo Policy): www.wqa.org/sitelogic.cfm?ID=1171
Certified Products Directory: www.wqa.org/goldseal/goldsealSearch.cfm

Additional Resource

Get the Lead Out Plumbing Consortium
Get the Lead Out℠ Resources: www.gettheleadoutplumbing.com/Resources.asp

Contacts

For questions regarding the lead content of a product: Contact the product manufacturer
For questions regarding this document: Contact Michelle Latham at latham.michelle@epa.gov

Certification Marks for

CSA Group

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for CSA Group, as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Marks

(1) Based on the intended product market, the marks may be accompanied by a "C" & "US" or just a "US". **(2)** Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below) must accompany the marks.

"US" = United States; "C" = Canada

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372):
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G):
Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372 (Standard 61 text may alternately include "61/9-G").

California AB1953, Section 116875 (e.g., AB 1953 (2006) or CA HSC §116875 [AB 1953 (2006)]):
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

Resources

Low Lead Requirements: *www.csagroup.org/us/en/industries/plumbing/low-lead-requirements*
Certification Marks: *www.csagroup.org/us/en/about-csa-group/certification-marks-labels*
Certified Product Listings: *www.csagroup.org/us/en/services/testing-and-certification/certified-product-listing*

Certification Marks for

ICC Evaluation Services (ICC-ES), LLC

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for ICC-ES, as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Mark

Text indicating certification to a lead-free certification identifier (listed in blue below) may be included next to the mark, but is not required.

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372)**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

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California HB AB1953, Section 116875 (e.g., AB 1953 (2006) or CA HSC §116875 [AB 1953 (2006)])**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

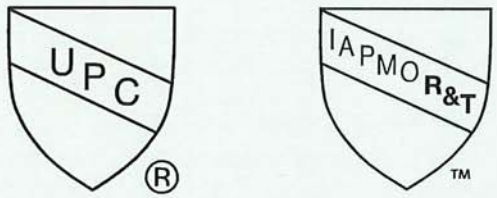
Resources
Listing Mark: *www.icc-es-pmg.org/Mark/*
Listing Directory: *www.icc-es-pmg.org/Listing_Directory/*

Certification Marks for

International Association of Plumbing and Mechanical Officials Research and Testing (IAPMO R&T)

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for IAPMO R&T, as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Marks



UPC®

(1) Based on the intended product market, the UPC shield and logo marks may be accompanied by a "C".
(2) Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below) or the term "Low Lead" must accompany the marks.

"C" = Canada

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372)**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

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Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

Resources
Marks of Conformity: *www.iapmort.org/Pages/MarksofConformity.aspx*
Product Listing Directory: *pld.iapmo.org/default.asp*

Certification Marks for

Intertek Testing Services NA, Inc.

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for Intertek Testing Services NA, Inc., as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Marks

(1) Marks can be black or reversed in white. **(2)** Based on the intended product market, the marks may be accompanied by a "C" or a "US" or both. **(3)** Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below) must accompany the marks.

"US" = United States; "C" = Canada

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372)**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G)**:**
Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372.

California HB AB1953, Section 116875 (e.g., AB 1953 (2006) or CA HSC §116875 [AB 1953 (2006)])**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

Resources
Mark Usage Guide: *www.intertek.com/marks-usage*
Product Directory: *www.intertek.com/directories/*

Certification Marks for

NSF International (NSF)

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for NSF, as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Marks

NSF-61-G

NSF-372

NSF pw-G

(1) Marks can be blue, white, or black. **(2)** Based on the intended product market, the marks may be accompanied by a "C" & "US" or just a "C". **(3)** Text indicating certification to an NSF/ANSI Standard (listed in blue below) must accompany circular marks. **(4)** Standard 61 circular and text marks may alternately include "**61/9-G**".

"US" = United States; "C" = Canada

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372)**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G)**:**
Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372.

Resources
Low Lead Compliant Products and Markings: *www.nsf.org/info/lowlead*
FAQs about NSF/ANSI 61 and Lead, and NSF/ANSI 372: *www.nsf.org/info/wdsfaq/*
Product Listings: *www.nsf.org/business/search_listings/*

Certification Marks for

Truesdail Laboratories, Inc.

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for Truesdail Laboratories, Inc., as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Mark

Text indicating certification to at least one of the lead-free certification identifiers (listed in blue below) must accompany the mark.

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372):
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G):
Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372.

California HB AB1953, Section 116875 (e.g., AB 1953 (2006) or CA HSC §116875 [AB 1953 (2006)]):
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

Resource
Mark and Plumbing Listings: *www.truesdail.com/specialty_testing/plumbing.html*

Certification Marks for

Underwriters Laboratories (UL), LLC

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for UL, as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Marks

UND. LAB. CLASSIFIED

UND. LAB. CLFD

(1) Based on the intended product market, the marks may be accompanied by a "C", "CA", "US", "C" & US", or "CA" & "US". **(2)** Text indicating certification to an NSF/ANSI Standard (listed in blue below) must accompany all the marks. **(3)** The File No. is a unique identification for a product used to search the UL online certification directory.

"US" = United States; "C" = Canada; "CA" = Canada

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372)**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G)**:**
Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372.

Resources
Certification Marks and UL Badges: *www.ul.com/global/eng/pages/corporate/aboutul/ulmarks/*
Online Certifications Directory: *database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/index.html*

Certification Marks for

Water Quality Association (WQA)

Starting January 4, 2014, the new lead-free requirement of the Reduction of Lead in Drinking Water Act will take effect. The prohibitions on use and introduction into commerce will apply to all pipe, pipe fittings, plumbing fittings, and fixtures (henceforth referred to as "products"), including stocked inventories that have not been installed. The information on this page provides the certification marks and required identifier text for WQA, as well as any additional remarks indicating that a product meets the new lead-free requirement.

Certification Marks

NSF/ANSI 372 by WQA

(1) The marks can be either gold or black and white. **(2)** Based on the intended product market, the marks may be accompanied by a "C" & "USA" or just a "C". **(3)** Text indicating certification to an NSF/ANSI Standard (listed in blue below) must accompany the marks.

"USA" = United States of America; "C" = Canada

Lead-Free Certification Identifiers

NSF/ANSI Standard 372 (NSF/ANSI 372 or NSF-372)**:**
Dictates that a product has been certified as meeting a weighted average lead content of ≤0.25% when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures.

NSF/ANSI Standard 61, Annex G (NSF/ANSI 61 Annex G or NSF 61-G)**:**
Dictates that a product has been certified as meeting leachate requirements for all contaminants (metals and non-metals), as well as the new lead-free requirements of NSF-372.

Resources
Use of the Gold Seal (Note - Click on download the Gold Seal Logo Policy): *www.wqa.org/sitelogic.cfm?ID=1171*
Certified Products Directory: *www.wqa.org/goldseal/goldsealSearch.cfm*

Certificate of Conformance

Birmingham Fastener Manufacturing
931 Avenue W,Ensley
Birmingham, Alabama 35214
(205) 595-3512

Customer: Etna Date: January 23, 2017

Item Description

Description: 3/4"-10 Fluorocarbon Coated T-Head Bolts Mfg Mark: 8

Specification: ANSI/AWWA C111/A21.11-07 Coating: Fluorokote #1

Raw Material Analysis

Grade: ASTM A242 Modified

Yield Strength: 45,000 psi Minimum Elongation in 2": 20% Minimum

C 0.20 max Mn 1.25 max S 0.05 max Ni 0.25 min Cu 0.20 min

Combined (Ni + Cu + Cr) 1.25 min

Mechanical Properties

Proof Load: 13,500 lbf minimum - 10 seconds minimum

Deformation: 0.002/unit length maximum

PROOF LOAD BASED ON 45,000 PSI

Coating Analysis

Coefficent of Friction: 0.02 - 0.10 Thickness: 0.0005 - 0.0025 in.

Continous Use Temperature: -420°F - 500°F Tensile Strength: 2,000 - 4,000 psi

Corrosion Resistance (Salt Spray ASTM B117): Up to 4,000 hrs

This information represents the minimum requirements of the described material. The referenced product will be in full compliance with ANSI/AWWA C111/A21 11.07 specification

Authorized Signature: Shawn Brasher DATE: 1/23/2017

Shawn Brasher
Sales

AA Thread Seal Tape, Inc.
PTFE Thread Seal Tapes | PTFE Universal Joint Sealants
Polyethylene Encasements for Ductile Iron Pipe
PVC Pipe Wrapping Tapes | Industrial Tapes & Supplies
SINCE 1979

Linear Low Density Polyethylene – Black (8MIL) Polywrap Pipe Sleeves

Specifications

Application: Barrier encasement of pipe to prevent corrosion in varying soil conditions

Product Specifications

Raw Material: Linear Low Density Polyethylene

Group: 2 (Linear)

Finished Material: Linear Low Density Polyethylene Film

Color: Black

Standard: ANSI/AWWA C105/A21.5

Test	AWWA C105 Min. Req.	AA Thread's Film*
Tensile Strength	3600psi MD/TD (ASTM D882)	MD-4495psi TD-4410psi
Elongation	800% Minimum MD/TD (ASTM D882)	MD-1073% TD-1126%
Dielectric Strength	800 V/MIL (ASTM D149)	1946V/MIL
Impact Resistance	600 grams (ASTM D1709)	1189 grams
Propagation Tear Resistance	2550 grams force MD/TD (ASTM D1922)	MD-4462 grams force TD-5539 grams force
Minimum Thickness	0.008" (8MIL)	0.008" (8 MIL)

*Tests are averages performed by independent lab results.

Markings: Material printed with AWWA Spec No., Pipe Diameter, Year of manufacturing, Manufacturing Mark, Warning of Corrosion Protection/Repair Damage.

Quotation

ejco.com
800 626 4653

Account Name	City of Owosso
Ship to	301 West Main Street, Owosso, MI, US, 48867
Bill to	Attention Accounts Payable 301 West Main Street, Owosso, MI, US, 48867
Full Name	Mark Mitchell
Business Phone	(989) 723-8844
Email	mark.mitchell@ci.owosso.mi.us
Business Fax	989-725-0525
Close Date	2/1/2018

Quote Number	00195150
Quote Name	Valve part numbers
Created Date	2/1/2018
Expiration Date	
Prepared by	Doug Schrauben
Email	doug.schrauben@ejco.com
Phone	
Fax	

Quantity	Product N°	Line Item Description	Notes		Sales Price (USD)	Total Price (USD)
1	22022	4" Resilient Wedge Gate Valve, Mechanical Joint End Connections, 2" Operating Nut, Open Right			408.32	408.32
1	22032	6" Resilient Wedge Gate Valve, Mechanical Joint End Connections, 2" Operating Nut, Open Right			514.10	514.10
1	22042	8" Resilient Wedge Gate Valve, Mechanical Joint End Connections, 2" Operating Nut, Open Right			827.77	827.77
1	22052	10" Resilient Wedge Gate Valve, Mechanical Joint End Connections, 2" Operating Nut, Open Right			1290.91	1290.91
1	22062	12" Resilient Wedge Gate Valve, Mechanical Joint End Connections, 2" Operating Nut, Open Right			1633.28	1633.28
1	55726D	5BR250 6'0" Bury, 1 1/8" Pentagon, 2-2 1/2"NST & 1-5"Storz Nozzle,Red, MJ Connection, Open Right, 2 Drains Tapped and Plugged			2109.18	2109.18
1	54727D	5BR250 5'-6" bury, 1 1/8" Pentagon, 2-3 3/4"NST& 1-5" Storz Nozzle, Yellow, MJ Connection, Open Right, Drains Tapped and Plugged			2070.68	2070.68
1	53726D	EJ 5BR250 HYD 5'0" MJ-2DTP 1HS			2032.18	2032.18

Subtotal	10886.42 USD
Grand Total	10886.42 USD

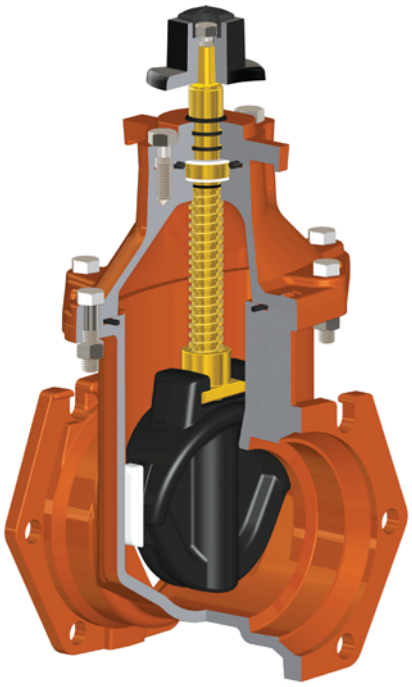
Quotation

ejco.com
800 626 4653

Quantity	Product N°	Line Item Description	Notes	Sales Price	Total Price

Notes and Comments

FlowMaster® Resilient Wedge Gate Valves



FlowMaster® Resilient Wedge Gate Valves are used in water and sewer systems. The valve incorporates quality parts and a simple design. All ductile iron construction delivers superior strength, impact resistance and reduced weight ensuring long service life. All valve parts are manufactured and assembled in the USA.

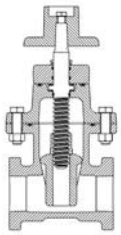
Standard Features

- Ductile iron body, bonnet, seal plate and wedge are manufactured from iron conforming to ASTM A536
- The operating stem is manufactured from high strength manganese bronze
- Meet or exceed the performance requirements of AWWA C515 and Underwriters Laboratories Standards UL262
- Wall thickness exceeds AWWA Standard C515 and C153
- Coating is certified to ANSI/NSF Standard 61
- Wedge is fully rubber encapsulated to meet ASTM D429 requirements
- 10 Year Limited Warranty

Options

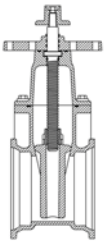
- End connections
- Sizes available 2" through 24"
- Handwheel
- Bevel or spur gear operators (20", 24")
- Indicator post valve
- Cut-end valve – oversized pipe

End Connection Options

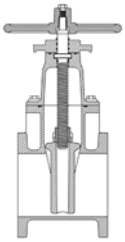


Threaded

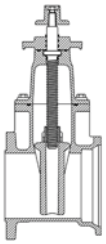
Mechanical Joint x Mechanical Joint



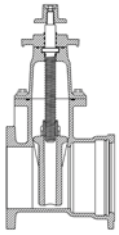
Mechanical Joint x Mechanical Joint with Indicator Post Valve



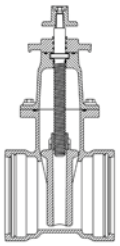
Flanged End x Flanged



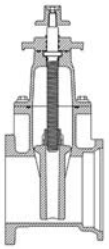
Mechanical Joint x Tapping



Tyton® x Flanged



Tyton® x Tyton®



Flanged End x Mechanical Joint

ROMAC INDUSTRIES, INC.

STYLE XR501
EXTENDED RANGE COUPLING

SUBMITTAL INFORMATION

Use:	Provides an Extended Range Coupling for multi-purpose use. One gasket, center ring and end ring for SDR 35 PVC sewer through Class 200 A/C pipe sizes. **Note: for pipe ODs smaller than standard steel do not exceed 20 PSI.**
AWWA C219	Romac 501 couplings meet the specifications set forth in the AWWA Standard C219 coupling spec.
MATERIALS	
Castings	The end rings and center rings are cast from ductile (nodular) iron, meeting or exceeding ASTM A 536, Grade 65-45-12.
Gaskets	Gaskets are made from virgin Styrene Butadiene Rubber (SBR) compounded for water and sewer service in accordance with ASTM D2000 MBA 810. Other compounds available for petroleum, chemical, or high temperature service.
Bolts and Nuts	5/8 inch, High strength low alloy steel trackhead bolts. National coarse rolled thread and heavy hex nuts. Steel meets AWWA C-111 composition specifications. Stainless steel bolts and nuts available on request.
Coatings	Shop coat applied to cast parts for corrosion protection in transit. Fusion bonded epoxy, liquid epoxy and other coatings available on request.
PRESSURE	When properly installed on standard steel pipe and larger the Romac Style XR501 coupling can be used at working pressures up to 260 psi. Higher working pressures available for specific applications. **Note: for pipe ODs smaller than standard steel do not exceed 20 PSI.**
SIZES AND RANGES	See Catalog. 7/07

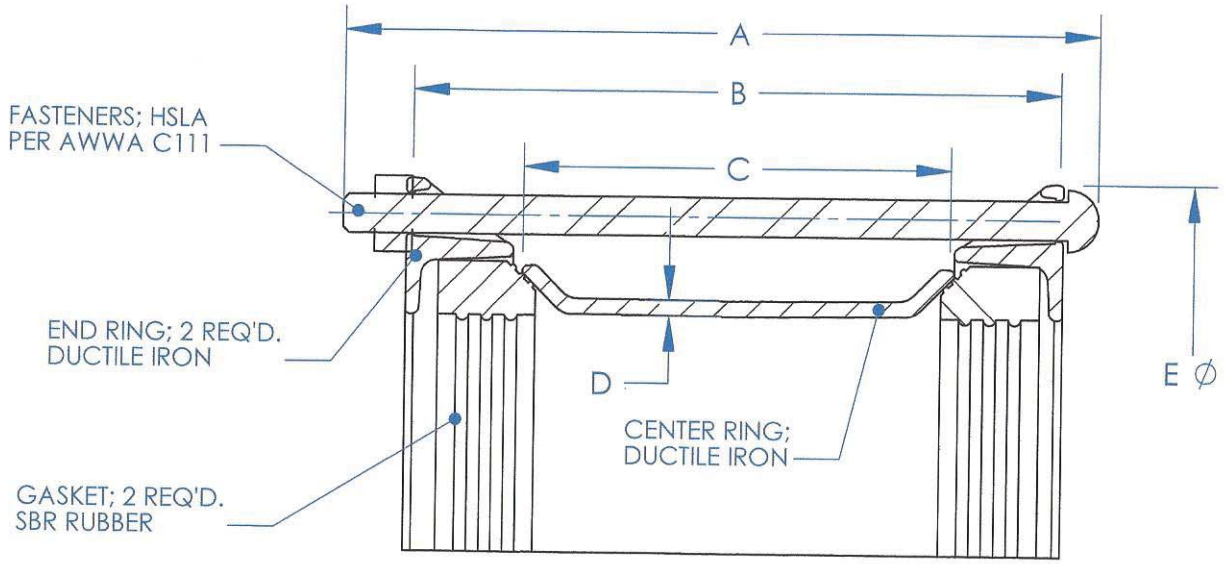
Romac Document Number 20-1-0022

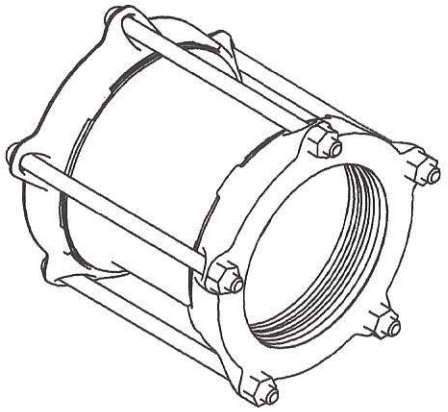
This information is based on the best data available at the date printed above, please check with Romac Engineering Department for any updates or changes.

B1899-A

NOTES:
1. DUCTILE IRON, ASTM 536, GRADE 65-45-12
2. FASTENERS OF TYPE 304 0R 316 STAINLESS STEEL OPTIONAL
3. GASKETS OF NBR OR EPDM OPTIONAL
4. SHOP COAT STANDARD, FUSION EPOXY OPTIONAL
5. ALL DIMENSIONS IN INCHES
6. WORKING PRESSURE UP TO 260 PSI. PIPE ODS SMALLER THAN STD STEEL SIZE NOT TO EXCEED 20 PSIG

REVISIONS			
REV.	DESCRIPTION	DATE	APPROVED
1	ADD 10 & 12 INCH SIZES	8/1/02	GFD
2	PIPE MIN DIA CHANGED ADDED NOTE 6	8/15/07	CJS





NOMINAL SIZE	A	B	C	D	E	BOLTS			PIPE DIAMETER	
						NO.	DIA.	LENGTH	MIN.	MAX
4	12.0	10.1	7.0	0.25	10.1	4	5/8	11 1/2	4.215	5.60
6	12.0	10.1	7.0	0.25	12.1	5	5/8	11 1/2	6.275	7.60
8	12.0	10.5	7.0	0.25	15.3	6	5/8	11 1/2	8.400	9.75
10	13.5	11.7	8.0	0.25	17.5	6	5/8	13	10.500	12.15
12	13.5	11.9	8.0	0.25	20.1	8	5/8	13	12.500	14.41

UNLESS OTHERWISE SPECIFIED

DIMENSIONS ARE IN INCHES

TOLERANCES ARE ON:
1 PL DECIMALS ± .060
2 PL DECIMALS ± .030
3 PL DECIMALS ± .010
ANGLES ± 1°
FRACTIONS ± 1/64

SIGNATURES
DRAWN
CHECKED
APPROVAL ORGANIZATIONS
PROP.CUST.APP. ORG.

ROMAC INDUSTRIES INC.,
BOTHELL, WA

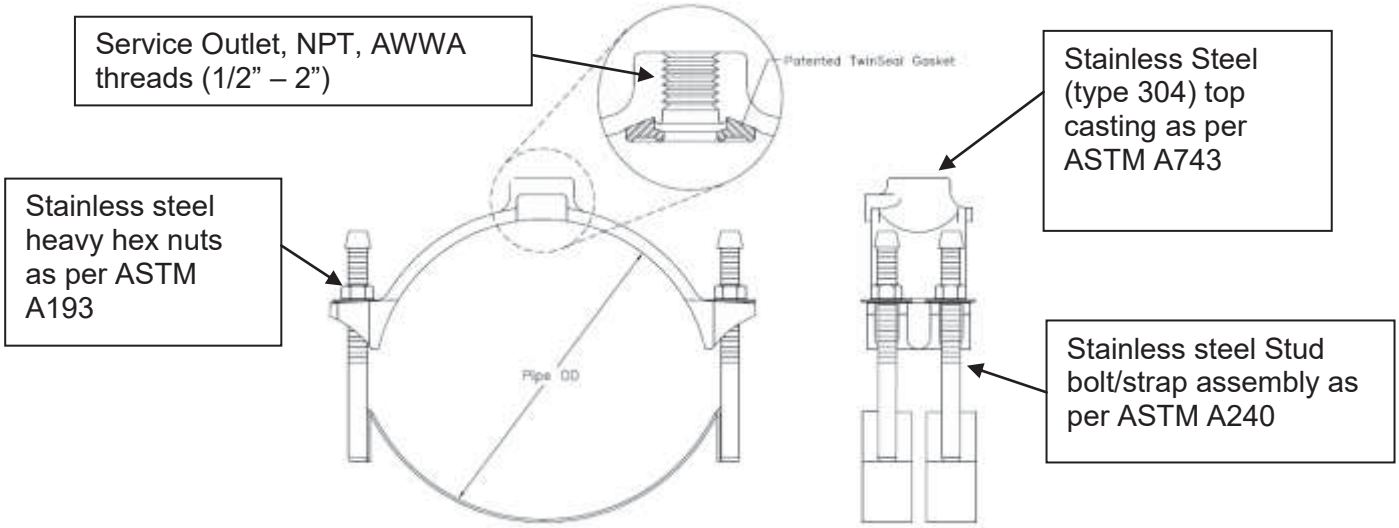
TITLE
XR501 COUPLING 4 - 12 INCH

DWG. NO.	SIZE	REV. NO.	SCALE	SHEET
B1899-A	A	2	NTS	1 OF 1

DRAWING FILE NAME: B1899 XR501
MODEL NAME: XR501 Customer DrawingSLDASM
CONFIGURATION NAME:Default
AUTHOR: PETER NIELSEN

Scope

The intent of the specification is to receive a 4" – 24" diameter all stainless steel saddle. The saddle furnished shall be equivalent to Model 3417AS as manufactured by PowerSeal Pipeline Products Corporation. This saddle is approved for use on **PVC Pipe, Steel pipe, C-900, C909, Ductile Iron, Cast Iron and Asbestos Cement Pipe.**



Pipe Size		Pipe Range	
IN		MIN	MAX
4	A	4.00	4.50
	B	4.74	5.63
	C	4.74	5.14
6	A	6.00	6.63
	B	6.84	7.64
	C	6.63	6.90
8	A	8.00	8.63
	B	8.54	10.10
	C	8.63	9.05
10	A	10.00	11.10
	B	10.64	12.12
12	A	12.00	13.20
	B	12.62	14.32
12-14	A	14.73	15.65
16-18	A	17.40	18.88
18	A	19.50	
20	A	21.60	
24	A	25.80	

PowerSeal PIPELINE PRODUCTS CORPORATION

Features and Benefits

1. Materials do not compromise the integrity of the pipeline.
2. Stud bolts MIG welded to straps, Heavy hex nuts with fusion bonded coating to prevent seizing and galling.
3. Saddles are available with NPT(IP), or AWWA (CC) tapped outlets ½" - 2"
4. NBR O-ring gasket design incorporating both hydrostatic and mechanical forces to produce a dynamic seal.

Design and Material Specification

1. The Stainless steel saddle shall meet or exceed all material specifications as listed below. The top casting of the Saddle shall be cast stainless steel as per ASTM A743.
2. The saddle shall have an O-ring gasket permanently attached to the casting at the factory.
   The o-ring gasket shall be the in NBR. It shall be free from porous areas, foreign material, and visible defects, all made from 100% new rubber. The NBR resists temperatures of -25 to +248ºF.
3. The MIG welded strap shall be stainless steel type 304. 5/8" stainless steel 304 stud bolts shall be welded to the straps and passivated to return the corrosive resistance.
4. The (AWWA or NPT) threaded outlet shall be individually CNC machined and inspected at the factory.
5. There shall be no paper or plastic adhesive labels attached to the saddle, any information appearing on the saddle shall be ink stenciled or cast lettering.

Material Specifications		
Part Name	**Material**	**Mat. specs**
Saddle Top	Cast Stainless Steel 304	ASTM A240
Strap	Stainless Steel Type 304	ASTM A 240
Nuts & Washers	Stainless Steel Type 304	ASTM A193
O-ring gasket	NBR	ASTM D2000

Sanchem Inc. • 1600 South Canal St. • Chicago, Illinois 60616 • Phone 312-733-6100 • Fax 312-733-7432 • 1-800-621-1603 • www.sanchem.com

Sanchem Inc

NO-OX-ID GG-2

Rust Preventive Coating & Lubricant

NO-OX-ID "GG-2" is a corrosion resistant coating that is often used to protect irregular fittings from galvanic corrosion and as a pipe joint thread compound. Non-oxidizing, moisture resistant highly durable soft wax corrosion material that has a high dielectric strength and prevents cross threading, cracking, or metal pipes from corroding. This cold applied compound rust preventative pipe coating and anti-seize compound is recommended for systems carrying air, steam, gas, ammonia, or water.

The NO-OX-ID GG-2 advantages are:

1. Contains no solvents perfect for VOC restricted areas.
2. Does not contain toxic unsafe coal tars
3. Requires no heating kettles – no fire in ditch.
4. No primer needed apply directly from can.
5. Requires NO DRY TIME, can be backfilled immediately after coating and wrapping with NO-OX-ID Pipe Wrap. Lower labor costs!
6. Foolproof – surface preparation is less critical than for mastic, coal tar or most other coatings – chance of failure is nil.
7. Can be applied over fittings that have a light oil without hurting performance.
8. NO-OX-ID GG-2 gives 2 times the coverage of mastics and 3 times the coverage of hot applied coal tars.
9. Costs of brushes for mastics vs gloves for GG-2 – brushes last 1 or 2 uses then must be replaced, a glove will last 6 months or more – what will be your savings?
10. Bolts coated with NO-OX-ID can be taken off <u>without</u> torching.
11. No deteriorating effects on plastic pipe, use on steel ties ins.
12. Refined base materials, best chemical corrosion inhibitors.
13. Minimum moisture penetration
14. No deterioration by oxidation, no change in composition.
15. No primer necessary. Strong secure bond with one application.

APPLICATION - Cold applied by hand - using canvas or leather faced glove. NO-OX-ID GG-2 can also be applied by airless spray equipment. NO-OX-ID GG-2 should be applied at 1/4 inch minimum coating thickness. Before application, steel surface should be clean, dry and free of foreign substances. No primer is required with NO-OX-ID GG-2.

USAGE IN POUNDS FOR 1/4" THICKNESS

These figures are calculated coverage requirement based on new pipe and do not include waste or other losses. Requirements for reconditioned pipe will be higher.

PIPE SIZE IN INCHES.	1,000 FT.	MILE
3/4	192	1,012
1	240	1,268
1-1/4	304	1,600
1-1/2	342	1,860
2	440	2,324
2-1/2	528	2,788
3	640	3,380
4	824	4,362
6	1,216	6,420
8	1,584	8,364
10	1,976	10,432
12	2,344	12,376
14	2,568	13,560
16	2,936	15,504
18	3,304	17,444
20	3,672	19,388

SPECIFICATIONS:

		Typical
DROP MELT POINT:	140° - 170°F	(150°F)
COG. POINT:	130° - 160°F	(140°F)
PENATRATION:	120 - 180	(140 - 150)
DENSITY:	0.85 - 0.92	(0.89)

COVERAGE - At a minimum thickness of 1/4 inch, it will require 0.7016 pounds of NO-OX-ID GG-2 per square foot of surface area.

STANDARD CONTAINER - 5 Gallon Pails @ 35/lbs Net per pail.

NO-OX-ID Protective Pipe Wrap - is a flexible, dense covering which is highly resistant to moisture and soil penetration. NO-OX-ID Protective wrap consists of a wax impregnated fabric mesh, which is laminated to a high tensile strength non-fibrous plastic membrane. This moisture proof shield easily forms around complex fittings for mechanical protection of the protective coating. Excellent protection of underground pipes can be achieved when used in combination with NO-OX-ID GG-2 which is our cold applied wax coating. This combination will give a protective coating system that will last for many years both on underground installations and for the protection of industrial plant piping where corrosion action is prevalent or where conditions are severe.

NO-OX-ID CORROSION PROTECTION PRODUCTS STOP RUST BEFORE IT STARTS

Sanchem Inc. · Chicago, IL · 312-733-6100 · 800-621-1603

MATERIAL SAFETY DATA SHEET

HMIS RATING: H-0 F-0 R-0

SECTION I - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: **NO-OX-ID "GG-2"**

COMPANY IDENTIFICATION:

SANCHEM, INC.
1600 S. CANAL STREET
CHICAGO IL 60616

TEL: 312-733-6100
CHEMTREC: 800-424-9300

SIGNATURE OF PREPARER: (Optional)

DATE: 02/11/09

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

According to current US Dept of Labor Standards, this Material Contains NO Toxic or Hazardous Chemicals

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point:	550°F	Specific Gravity (H_2O = 1):	1.0
Vapor Pressure (mm Hg.):	N/A	Melting Point:	150°F
Vapor Density (AIR = 1):	N/A	Evaporation Rate: (Butyl Acetate = 1):	N/A
Solubility in Water:	Insoluble		
Appearance and Odor:	Gray Paste – Odorless		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA

Flash Point (Method Used):	425°F C.O.C.
Flammable Limits:	LEL 0.9 UEL 6.0
Extinguishing Media:	Dry Chemical, Sand or Foam
Special Fire Fighting Procedures:	None
Unusual Fire and Explosion Hazards:	None

SECTION V - REACTIVITY DATA

Stability:	Stable
Conditions to Avoid:	Open Flame or Excessive Heat
Incompatibility (Materials to Avoid):	Strong Oxidizers
Hazardous Polymerization:	Will Not Occur

SECTION VI - HEALTH HAZARD DATA

Routes of Entry:	Inhalation:	N/A
	Skin:	Yes
	Ingestion:	Yes
Health Hazards (Acute and Chronic):	N/A:	
Carcinogenicity:	NTP?	No
	IARC Monographs?	No
	OSHA Regulated ?	No
Signs and Symptoms of Exposure:	May Cause Minor Skin Irritation	
Medical Conditions Generally Aggravated by Exposure:	None Known	
Emergency and First Aid Procedures:	Skin:	Wash Area with Soap and Water
	Ingestion:	Induce Vomiting

SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

Released or Spilled:	Scoop up an Store in Sealed Steel Drums. Wash Area Down with Soap and Water.
Waste Disposal Method:	Normal Scavenger
Storage and Handling:	Store in Cool Dry Area away from Open Flames and Excessive Heat
Other Precautions:	Do not Store Near Oxidizers

SECTION VIII - CONTROL MEASURES

Respiratory Protection:	Not Required
Ventilation:	Not Required
Protective Gloves:	Rubber
Eye Protection:	Goggles
Protective Clothing or Equipment:	Not Required
Work/Hygienic Practices:	Wash Hands Before Eating

SECTION IX - DISCLAIMER

The information in this MSDS was obtained from current and reputable sources. The data is provided without any warranty, express or implied, regarding its correctness or accuracy. It is the user's responsibility to determine safe conditions for product usage and to assume liability for loss, injury, damage or expense resulting from improper use.

REVISED
2/2018
po/mm

Sewer/Water Utility - Trace Wire Specification

Materials

General

All trace wire and trace wire products shall be domestically manufactured in the U.S.A.

All trace wire shall have HDPE insulation intended for direct bury, color coated per APWA standard for the specific utility being marked.

Trace wire

- **Open Trench -** Trace wire shall be #10 AWG Copper Clad Steel, High Strength with minimum 450 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Directional Drilling/Boring -** Trace wire shall be #10 AWG Copper Clad Steel, Extra High Strength with minimum 1,150 lb. break load, with minimum 30 mil HDPE insulation thickness.
- **Trace wire – Pipe Bursting/Slip Lining -** Trace wire shall be 7 x 7 Stranded Copper Clad Steel, Extreme Strength with 4,700 lb. break load, with minimum 50 ml HDPE insulation thickness.

Connectors

- All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At Crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative.
- **Direct bury wire connectors** – shall include 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion, and shall be installed in a manner so as to prevent any uninsulated wire exposure.
- Non locking friction fit, twist on or taped connectors are prohibited.

Termination/Access

- All trace wire termination points must utilize an approved trace wire access box (above ground access box or grade level/in-ground access box as applicable), specifically manufactured for this purpose.
- All grade level/in-ground access boxes shall be appropriately identified with “sewer” or “water” cast into the cap and be color coded.
- A minimum of 2 ft. of excess/slack wire is required in all trace wire access boxes after meeting final elevation.
- All trace wire access boxes must include a manually interruptible conductive/connective link between the terminal(s) for the trace wire connection and the terminal for the grounding anode wire connection.
- Grounding anode wire shall be connected to the identified (or bottom) terminal on all access boxes.

This Standard specification was prepared by Joe Rubbelke (joe.rubbelke@gmail.com), Jeff Dale (jeff.dale@mrwa.com) and Frank Stuemke (frank.stuemke@mrwa.com), and is a work-in-progress, intended for redistribution, modification and immediate use by any municipality (March 2014). The end user must accept all liabilities and hold harmless the contributors of this information.

Sewer/Water Utility - Trace Wire Specification

- **Service Laterals on public property** - Trace wire must terminate at an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway.
- **Service Laterals on private property** - Trace wire must terminate at an approved above-ground trace wire access box, affixed to the building exterior directly above where the utility enters the building, at an elevation not greater than 5 vertical feet above finished grade, or terminate at an approved grade level/in-ground trace wire access box, located within 2 linear feet of the building being served by the utility.
- **Hydrants** – Trace wire must terminate at an approved above-ground trace wire access box, properly affixed to the hydrant grade flange. (affixing with tape or plastic ties shall not be acceptable)
- **Long-runs, in excess of 500 linear feet without service laterals or hydrants** - Trace wire access must be provided utilizing an approved grade level/in-ground trace wire access box, located at the edge of the road right-of-way, and out of the roadway. The grade level/in-ground trace wire access box shall be delineated using a minimum 48" polyethylene marker post, color coded per APWA standard for the specific utility being marked.

Grounding

- Trace wire must be properly grounded at all dead ends/stubs
- Grounding of trace wire shall be achieved by use of a drive-in magnesium grounding anode rod with a minimum of 20ft of #14 red HDPE insulated copper clad steel wire connected to anode (minimum 0.5 lb.) specifically manufactured for this purpose, and buried at the same elevation as the utility.
- When grounding the trace wire at dead ends/stubs, the grounding anode shall be installed in a direction 180 degrees opposite of the trace wire, at the maximum possible distance.
- When grounding the trace wire in areas where the trace wire is continuous and neither the mainline trace wire or the grounding anode wire will be terminated at/above grade, install grounding anode directly beneath and in-line with the trace wire. Do not coil excess wire from grounding anode. In this installation method, the grounding anode wire shall be trimmed to an appropriate length before connecting to trace wire with a mainline to lateral lug connector.
- Where the anode wire will be connected to a trace wire access box, a minimum of 2 ft. of excess/slack wire is required after meeting final elevation.

Installation

General

- Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

Sewer/Water Utility - Trace Wire Specification

- Any damage occurring during installation of the trace wire must be immediately repaired by removing the damaged wire, and installing a new section of wire with approved connectors. Taping and/or spray coating shall not be allowed.
- Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.
- Trace wire must be properly grounded as specified.
- Trace wire on all service laterals/stubs must terminate at an approved trace wire access box located directly above the utility, at the edge of the road right-of-way, but out of the roadway. (See Trace wire Termination/Access)
- At all mainline dead-ends, trace wire shall go to ground using an approved connection to a drive-in magnesium grounding anode rod, buried at the same depth as the trace wire. (See Grounding)
- Mainline trace wire shall not be connected to existing conductive pipes. Treat as a mainline dead-end, ground using an approved waterproof connection to a grounding anode buried at the same depth as the trace wire.
- All service lateral trace wires shall be a single wire, connected to the mainline trace wire using a mainline to lateral lug connector, installed without cutting/splicing the mainline trace wire.
- In occurrences where an existing trace wire is encountered on an existing utility that is being extended or tied into, the new trace wire and existing trace wire shall be connected using approved splice connectors, and shall be properly grounded at the splice location as specified.

Sanitary Sewer System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay mainline trace wire continuously, by-passing around the outside of manholes/structures on the North or East side.
- Trace wire on all sanitary service laterals must terminate at an approved trace wire access box color coded green and located directly above the service lateral at the edge of road right of way.

Water System

- A mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.
- Trace wire on all water service laterals must terminate at an approved trace wire access box color coded blue and located directly above the service lateral at the edge of road right of way.
- Above-ground tracer wire access boxes will be installed on all fire hydrants.
- All conductive and non-conductive service lines shall include tracer wire.

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Sewer/Water Utility - Trace Wire Specification

Storm Sewer System

This section shall be included at the discretion of the facility owner.

- If the storm sewer system includes service laterals for connection of private drains and tile lines, it shall be specified the same as a sanitary sewer application.
- Lay mainline trace wire continuously, by-passing around the outside of manholes/structure on the North or East side.

Prohibited Products and Methods

The following products and methods shall not be allowed or acceptable

- Uninsulated trace wire
- Trace wire insulations other than HDPE
- Trace wires not domestically manufactured
- Non locking, friction fit, twist on or taped connectors
- Brass or copper ground rods
- Wire connections utilizing taping or spray-on waterproofing
- Looped wire or continuous wire installations, that has multiple wires laid side-by-side or in close proximity to one another
- Trace wire wrapped around the corresponding utility
- Brass fittings with trace wire connection lugs
- Wire terminations within the roadway, i.e. in valve boxes, cleanouts, manholes, etc.
- Connecting trace wire to existing conductive utilities

Testing

All new trace wire installations shall be located using typical low frequency (512Hz) line tracing equipment, witnessed by the contractor, engineer and facility owner as applicable, prior to acceptance of ownership.

This verification shall be performed upon completion of rough grading and again prior to final acceptance of the project.

Continuity testing in lieu of actual line tracing shall not be accepted.

Sewer/Water Utility - Trace Wire Specification

Products

The following products have been deemed acceptable and appropriate. These products are a guide only to help you choose the correct applications for your tracer wire project.

- Copper clad Steel (CCS) trace wire
  - Open Trench – Copperhead #12 High Strength part # 1230-HS
  - Directional Drilling/Boring - Copperhead Extra High Strength part # 1245*EHS
  - Pipe Bursting/Slip Lining – Copperhead SoloShot Extreme Strength 7 x 7 Stranded part # PBX-50
- Connectors
  - Copperhead 3-way locking connector part # LSC1230*
  - DryConn 3- way Direct Bury Lug: Copperhead Part # 3WB-01
- Termination/Access
  - Non-Roadway access boxes applications: Trace wire access boxes Grade level Copperhead adjustable lite duty Part # LD14*TP
  - Concrete / Driveway access box applications: Trace wire access boxes Grade level Copperhead Part # CD14*TP 14”
  - Fire hydrant trace wire access box applications: Above ground two terminal with 1” conduit. Copperhead part # T3-75-F (Cobra T3 Test Station, denoting “F” includes mounting flange)
- Grounding
  - Drive in Magnesium Anode: Copperhead Part # ANO-1005 (1.5 lb)

Manufacture product options:

The information provided by Copperhead Industries gives you product options to help you choose the correct wire – termination/access points – connectors and grounding products. Other manufactures provide these products; this information is only a guide.

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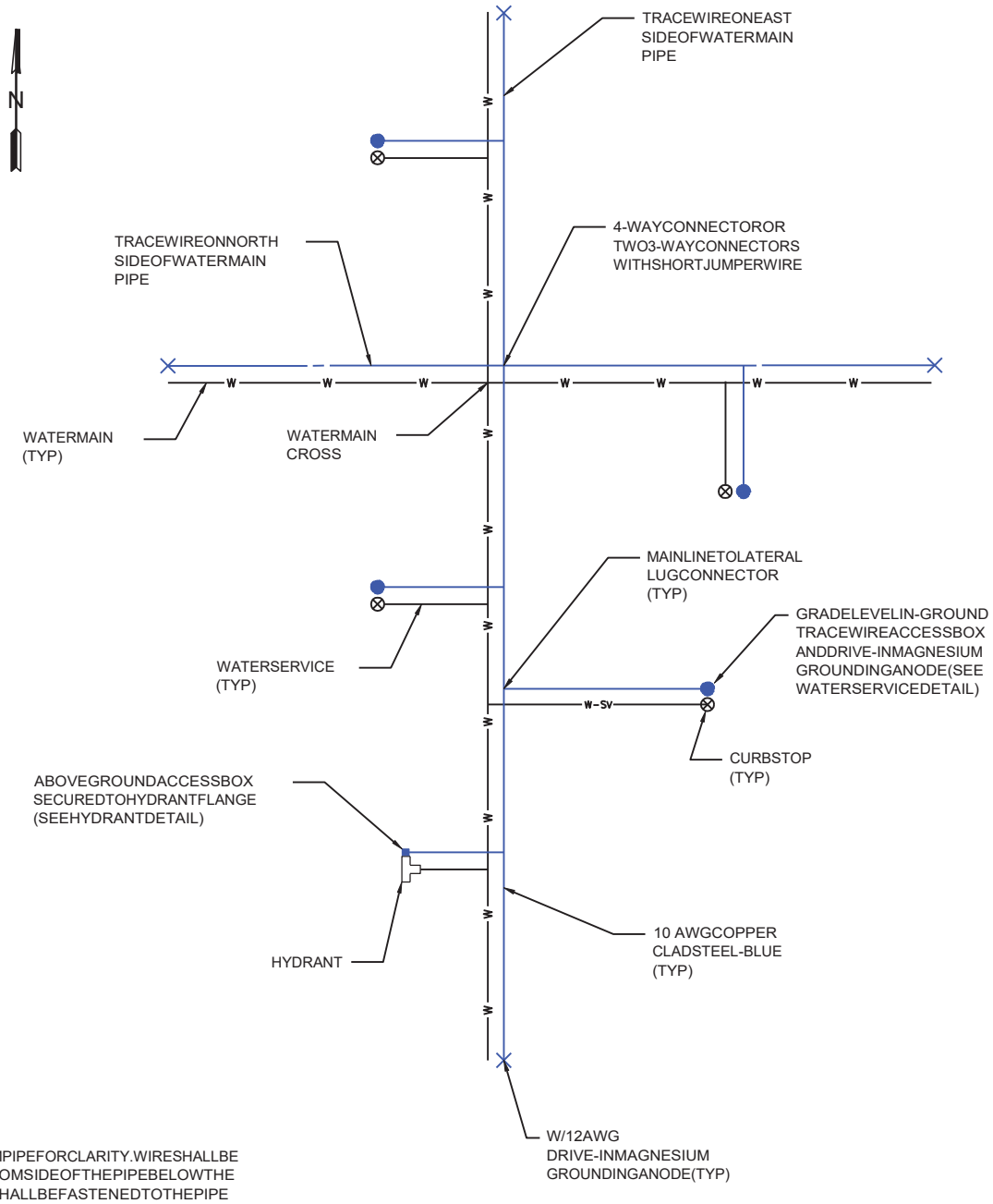

NOTES:
1. WIRESHOWNAWAYFROMPIPEFORCLARITY.WIRESHALLBE INSTALLEDONTHEBOTTOMSIDEOFTHEPIPEBELOWTHE SPRINGLINE.THEWIRESHALLBEFASTENEDTOTHEPIPE WITHTAPEORPLASTICTIESAT5'INTERVALS.

TRACEWIREPLAN(WATER)

NOSCALE

MICHIGAN RURALWATERASSOCIATION
STANDARDDETAIL

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TRACEWIRE
SAMPLEWATERPLAN

May28,2014

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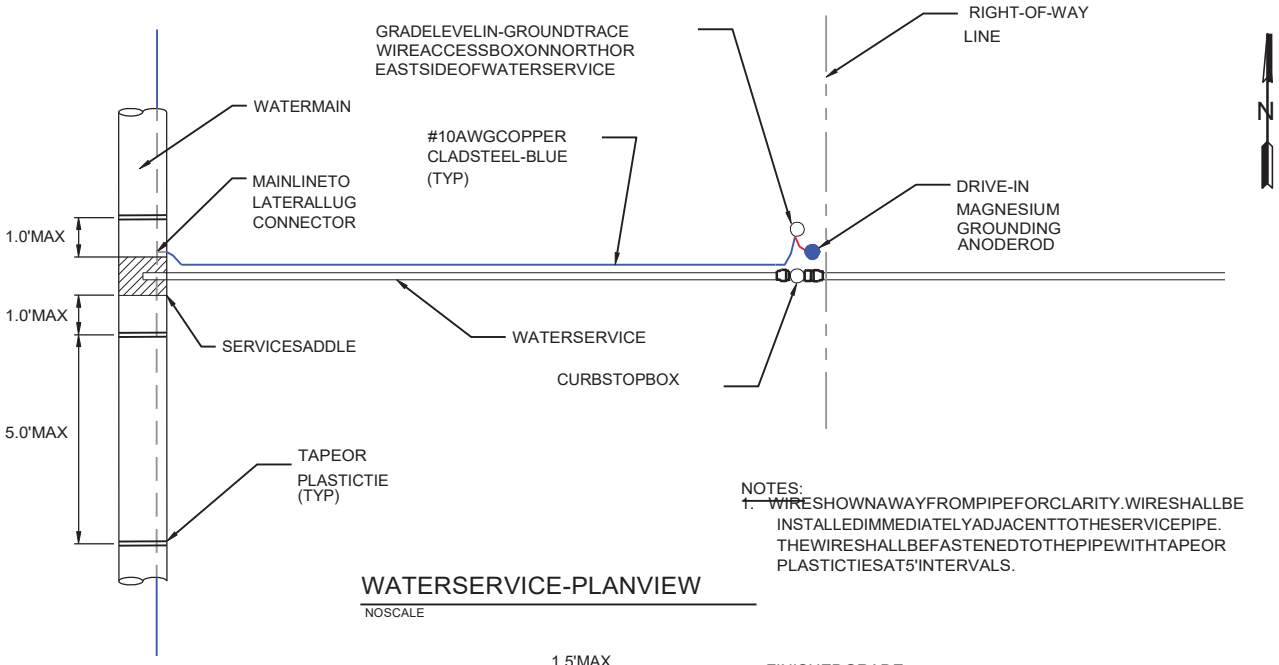

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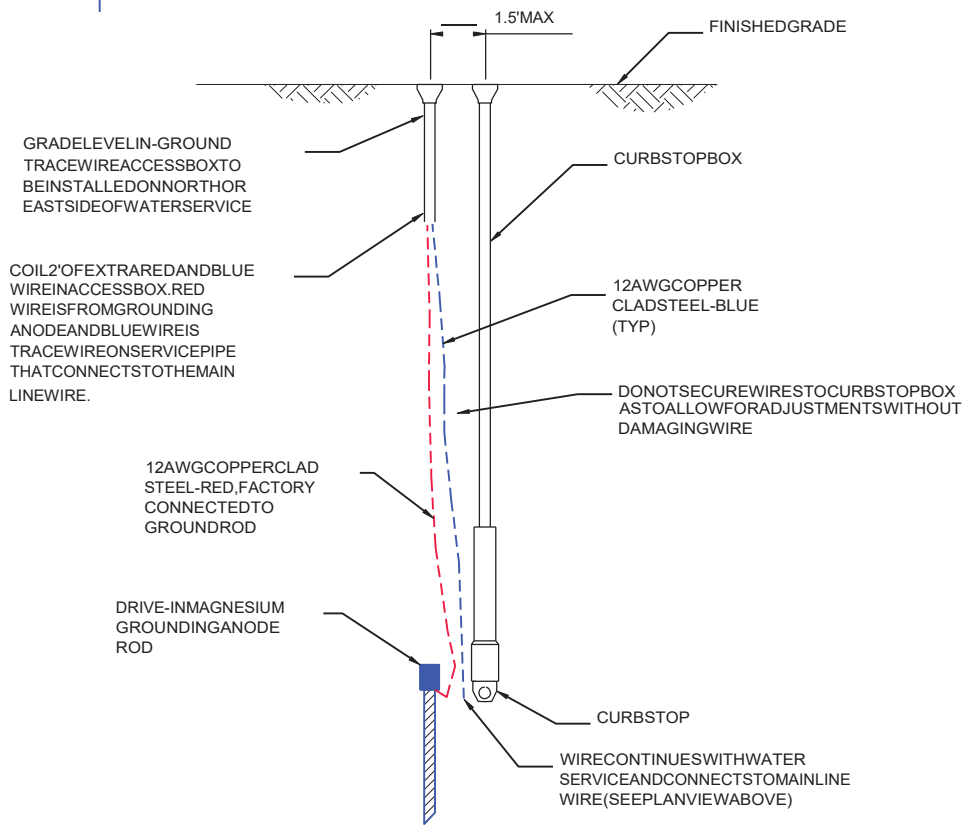
WATERSERVICE-PLANVIEW

NOSCALE



WATERSERVICE-SECTIONVIEW

NOSCALE

MICHIGAN RURALWATERASSOCIATION
STANDARDDETAIL

TRACEWIRE
WATERSERVICEDETAIL

May28,2014

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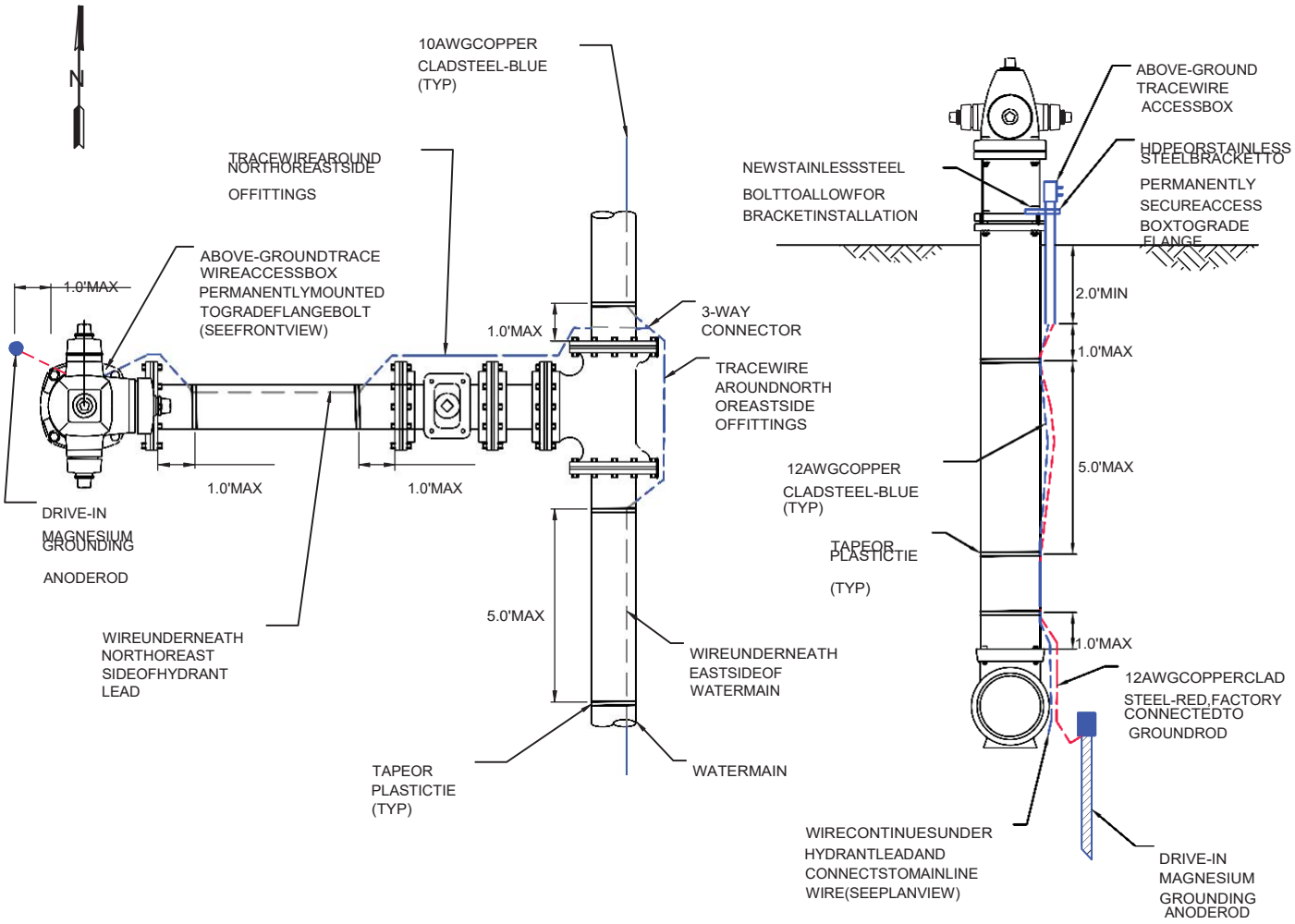

HYDRANT-PLANVIEW

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HYDRANT-SECTIONVIEW

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STANDARDDETAIL

TRACEWIRE
HYDRANTDETAIL

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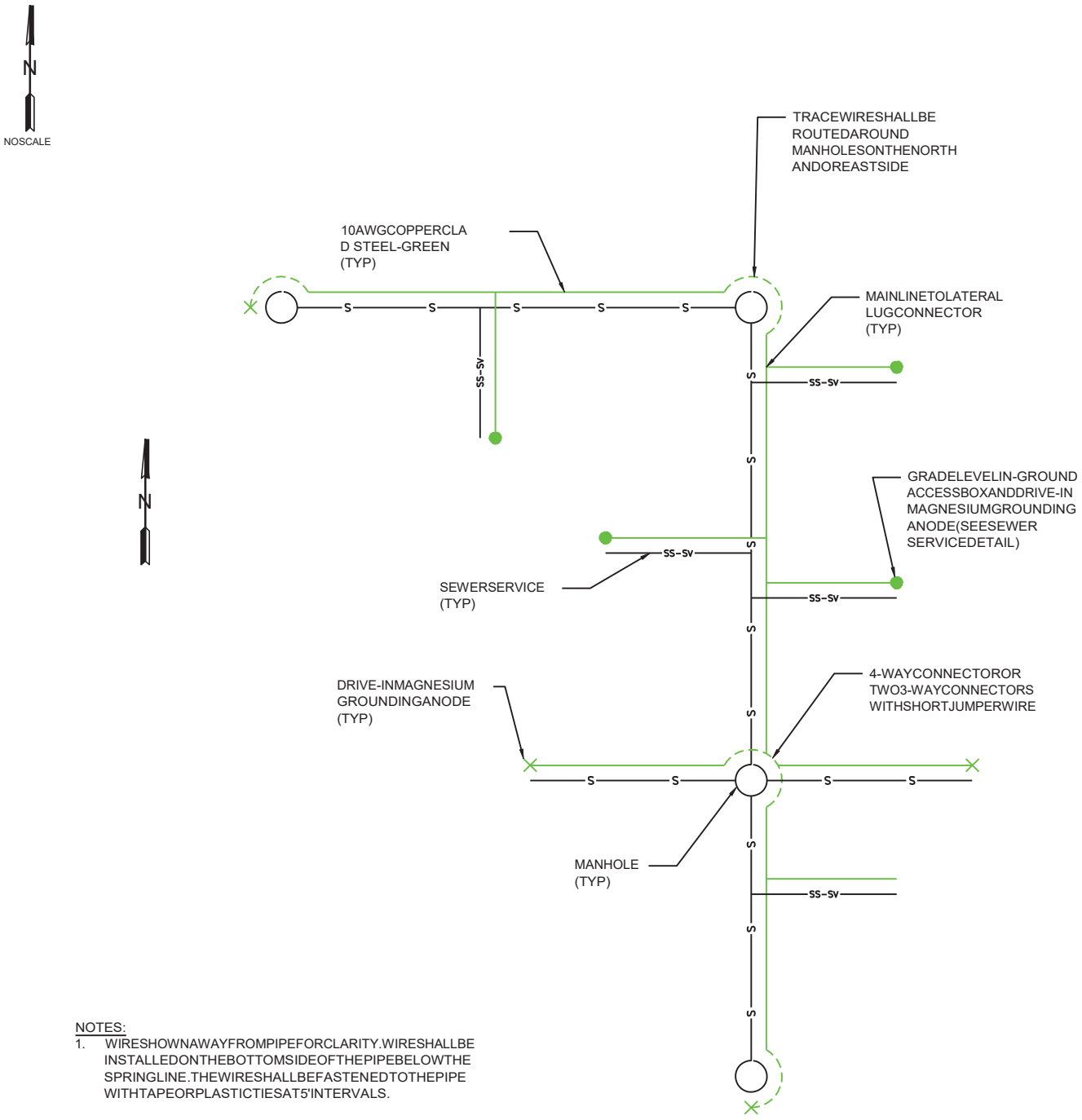

NOTES:

1. WIRESHOWNAWAYFROMPIPEFORCLARITY.WIRESHALLBE INSTALLEDONTHEBOTTOMSIDEOFTHEPIPEBELOWTHE SPRINGLINE.THEWIRESHALLBEFASTENEDTOTHEPIPE WITHTAPEORPLASTICTIESAT5'INTERVALS.

TRACEWIREPLAN(SEWER)

NOSCALE

MICHIGANRURALWATER ASSOCIATION
STANDARDDETAIL

TRACEWIRE
SAMPLESEWERPLAN

May28,2014

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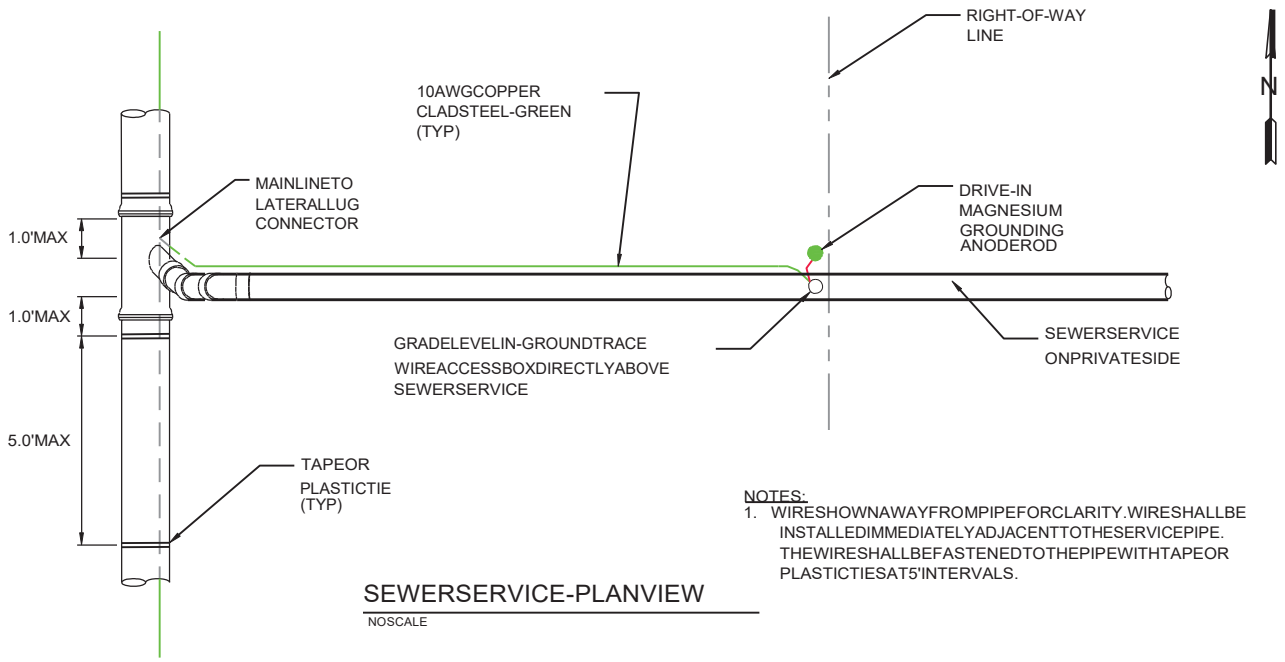

NOTES:
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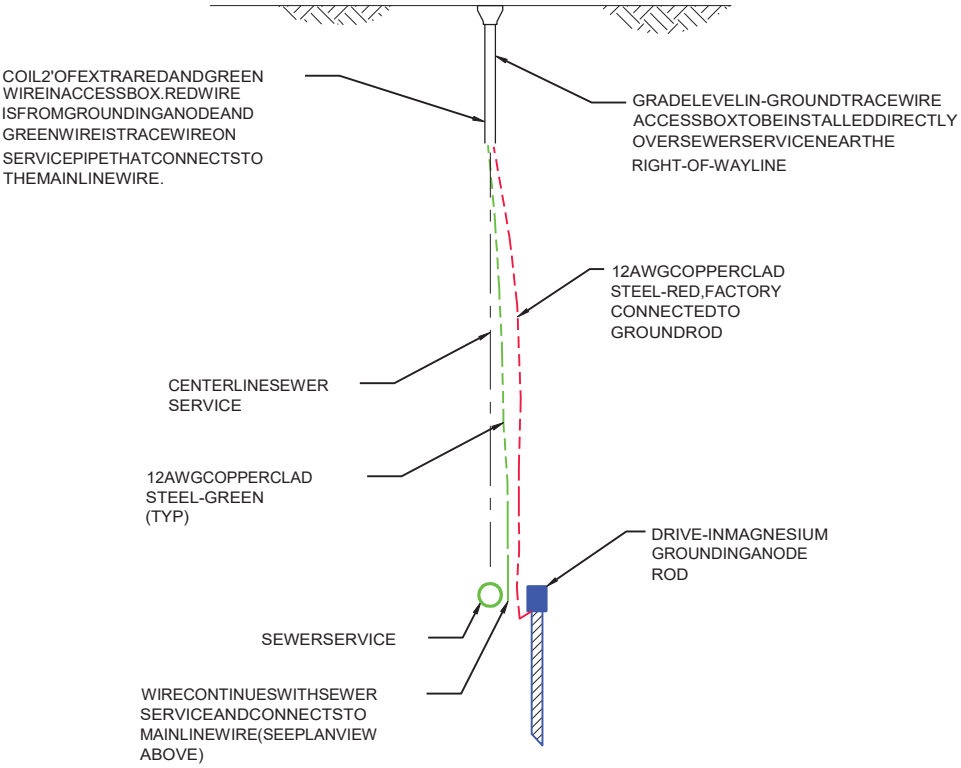
SEWERSERVICE-PLANVIEW

NOSCALE



SEWERSERVICE-SECTIONVIEW

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MICHIGAN RURAL WATER ASSOCIATION
STANDARD DETAIL

TRACEWIRE
SEWERSERVICEDETAIL

May28,2014

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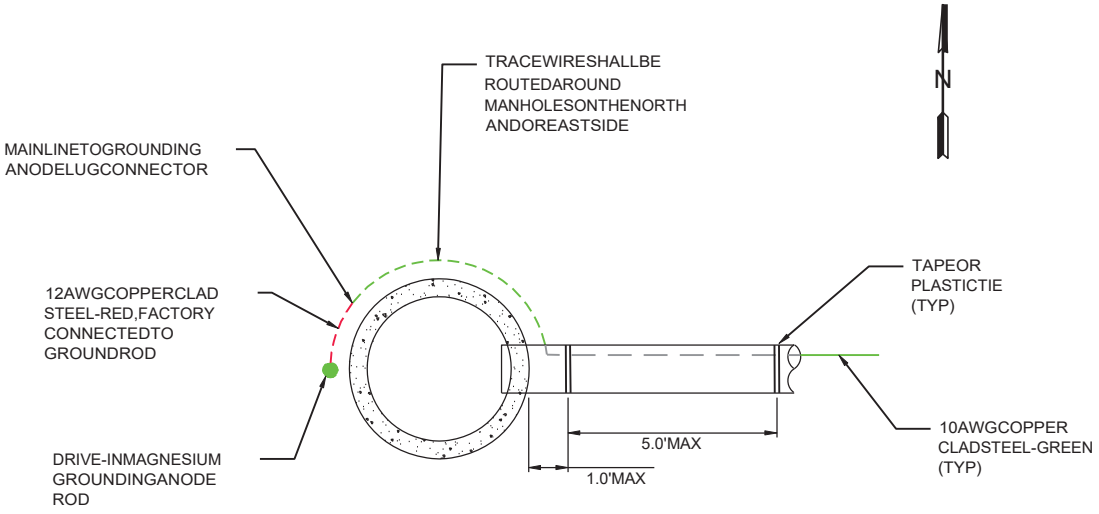

SEWERMANHOLE-PLANVIEW

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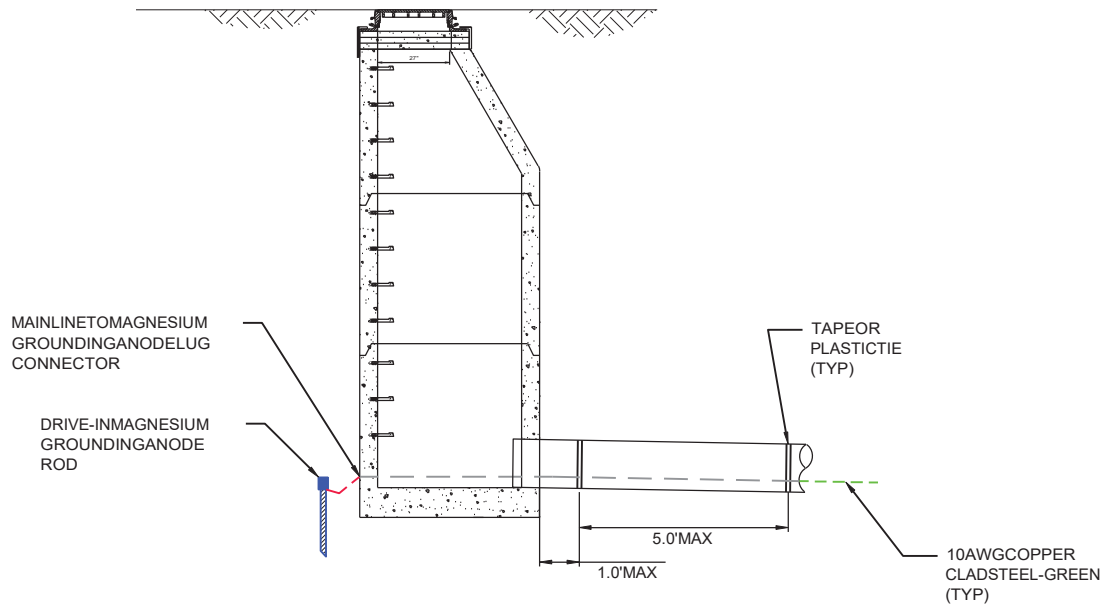

SEWERMANHOLE-SECTIONVIEW

NOSCALE

MICHIGAN RURAL WATER ASSOCIATION
STANDARDDETAIL

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TRACEWIRE
SEWERMANHOLEDETAIL

May28,2014

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a. Description.

1.01 SUMMARY:

A. This Section includes the work required to install a carrier or casing pipe for underground utilities under an obstacle using the method commonly known as horizontal directional drilling (HDD), to the grades and alignments shown on the Drawings.

1.02 REFERENCES:

A. ASTM - American Society of Testing Materials, *Latest Edition.*

B. PPI - Plastics Pipe Institute

C. AWWA - American Water Works Association

D. ANSI - American National Standards Institute

1.03 GENERAL REQUIREMENTS:

A. The CONTRACTOR shall be responsible for the method of construction, the stability and accuracy of the drilled and reamed hole and pits constructed, and all costs for damages resulting from any failure thereof. The CONTRACTOR shall be solely responsible for the safety of the pits and related structures and personnel engaged in underground construction throughout the duration of the work.

B. The CONTRACTOR's methods and schedule shall consider the overall project requirements and anticipated subsurface soils and groundwater conditions. The CONTRACTOR's selection of inadequate, inappropriate or inefficient equipment and methods will not be cause for adjustments to the contract price or contract time.

C. The general dimensions, arrangement and details for the drilled hole and pits to be constructed shall be as needed to complete the required work.

D. Methods of excavation, equipment and procedures for the directional drilling operation and pits shall be selected by the CONTRACTOR to provide adequate working space and clearances for the work to be performed.

E. Pit excavation methods, groundwater control and pit support techniques shall be selected by the CONTRACTOR.

F. The CONTRACTOR shall comply with the HDD Plan for Preventing and Controlling the Loss of Drilling Mud in Paragraph 3.15 SCHEDULES.

1.04 CONTRACTOR QUALIFICATIONS:

A. The CONTRACTOR who will complete the work contained in this Section must be experienced in the type of work specified in this Section and must have successfully completed similar projects within the last three years.

B. Personnel that will perform the work must be trained and experienced in the fabrication and installation of the materials and equipment, as well as being knowledgeable of the design and the reviewed shop drawings.

C. At the ENGINEER's request, the CONTRACTOR responsible for the completion of the work contained in this Section shall submit a list of jobs successfully completed within the last three years. Information on each job must include the following:
   1. Date of Project
   2. Location
   3. Length of Directional Drill
   4. Size and Material of Pipe
   5. General CONTRACTOR's name, contact and phone number.
   6. OWNER's name, contact and phone number.
   7. Other information relevant to the successful completion of the project.

1.05 SAFETY:

A. The CONTRACTOR shall become familiar with, and shall at all times conform to, all applicable codes, ordinances and laws in relation to the work required.

B. Directional drilling equipment machine safety requirements shall include a common grounding system to prevent electrical shock in the event of a high voltage underground cable strike. The grounding system shall connect all pieces of interconnecting machinery; the drill, mud mixing system, drill power unit, drill rod trailer, operator's booth, worker grounding mats and any other interconnected equipment to a common ground. The drill shall be equipped with an "electrical strike" audible and visual warning system that shall notify the system operators of an electrical strike.

C. Operators of the drill shall wear electrical shock protection equipment and operate from common grounding mats as required.

1.06 SUBMITTALS:

A. Submit in accordance with SECTION 01 33 00 - SUBMITTALS.

B. Proposed drill profile data including the minimum information listed below:
   1. Entrance angle
   2. Exit angle
   3. Minimum radius of curvature
   4. Depth of pipe every 50 feet
   5. Pilot hole diameter
   6. Back ream hole diameter
   7. Wet or dry pullback
   8. Estimated maximum pullback force

C. Polyethylene pipe data including, but not limited to, the following:
   1. Manufacturer's brochures and catalog sheets
   2. Dimensions
      a. Inside diameter
      b. Outside diameter
      c. Standard dimension ratio
      d. Yield stress

D. PVC to DI connection and restraint:
   1. Manufacturer
   2. Product data sheet
   3. Dimension drawing
   4. Installation instructions

E. Drilling Fluid:
   1. Bentonite (or alternate):
      a. Product manufacturer
      b. Product data sheet
      c. Mixing instructions
   2. Polymer:
      a. Product manufacturer
      b. Product data sheet
      c. Mixing instructions
      d. Material safety data sheet (MSDS)

F. Drill Path Documentation upon completion: See Article 3.07.

1.07 DELIVERY, STORAGE AND HANDLING:

A. Handle and store materials in a manner that will prevent:
   1. Deterioration or damage
   2. Contamination with foreign matter
   3. Damage by weather or elements

B. After the pipe is fused together and before it is pulled through the drilled hole, the CONTRACTOR shall be responsible to provide vehicular and emergency access to all properties affected by the fused pipeline. The CONTRACTOR shall be responsible to repair all damage to existing surface and site improvements damaged by the fused pipeline.

1.08 UTILITY PROTECTION:

A. All underground utilities shown on the drawings are shown according to the best available information. It is the CONTRACTOR's responsibility to verify the location of all existing utilities prior to working in the area.

B. All utilities are to remain in service and shall be protected by the CONTRACTOR from any damage as a result of his operations.

C. Where utilities are encountered and are not shown on the drawings, the CONTRACTOR shall report them to the OWNER before proceeding with the work.

D. All utilities damaged by the CONTRACTOR's activities shall be repaired or replaced by the CONTRACTOR without preventable delay. All costs to repair the utility including, but not limited to, materials, labor, inspection, testing and temporary service shall be born by the CONTRACTOR with no cost to the OWNER.

E. All utilities in close proximity to the drill pilot bore, back ream or product pipe installation must be exposed in accordance with all codes, ordinances and regulations to ensure, by visual inspection, that the CONTRACTOR's work has not caused any damage to the utility or to the CONTRACTOR's work and adequate clearance between the utility and the CONTRACTOR's work is maintained.

1.09 APPLICABLE REGULATIONS:

A. All work covered by this Section shall be performed in accordance with all applicable federal, state and local laws, regulations, codes and ordinances which pertain to such work, as well as the supplemental regulations contained in these specifications. If a conflict exists between any laws, regulations, codes or ordinances, the most stringent shall govern.

b. Materials

2.01 MATERIALS:

1. PVC Pipe: Polyvinyl-chloride Fusible (PVC) pipe shall be of a class and designation as shown on Drawings, with a DR of 18 to 14 or less compound designation Class No. 12454, ASTM-D1784. PVC pipe shall be in accordance with current AWWA Standard C-900 (4-12 inches).

2. The pipe shall have a nominal diameter as indicated on the plans and a standard dimension ratio (SDR) of no greater than 18 with a working pressure rating of 235 psi and no less than 14 with a working pressure rating of 305 psi.

3. The CONTRACTOR is responsible for calculating loads placed on the pipe during its installation based on the CONTRACTOR's chosen means and methods of construction. It is the CONTRACTOR's responsibility to ensure the pipe will withstand all loadings placed on it during installation. If the pipe with dimensions given above will not withstand the installation loads, it is the CONTRACTOR's responsibility to size the pipe to withstand the installation loads.

4. Manufacturers:
   a. Phillips Driscopipe, Inc.
   b. Chevron Chemical Company (Plexco)
   c. or Engineer approved equal

B. DRILLING FLUIDS
   1. The CONTRACTOR must use a high quality Bentonite drilling fluid or equivalent to ensure hole stabilization, cuttings transport, bit and electronics cooling, and hole lubrication to reduce drag on the drill pipe and the product pipe. Oil-based drilling fluids or fluids containing additives that can contaminate the soil or ground water will not be considered acceptable substitutes. Composition of the drilling fluid must comply with all federal, state and local environmental regulations.
   2. Polymer used as lubrication in the drilling fluid is acceptable, if desired.
   3. Drilling fluids must be mixed with water that is free from significant solids and contamination. Potable water is acceptable. River water is acceptable provided no organic matter or soil particulates are mixed into the drilling fluid. It is the CONTRACTOR's responsibility to apply for and obtain any necessary permits for the procurement of drilling fluid water. It is also the CONTRACTOR's responsibility to pay permit application fees, metering charges or any other costs associated with drilling fluid mixing water.

C. PVC TO DUCTILE IRON CONNECTION
   1. A restrained connection between the PVC pipe and DI pipe shall be made with a self-restraining, fusible, molded PE3408 mechanical joint adapter meeting the requirements of ASTM D2513 and ANSI/AWWA C906 and manufactured by Central Plastics Company or approved equal. The mechanical joint adapter shall be of the same SDR rating as the pipe. Additional restraint shall be provided on the ductile iron pipe side of the connection point by restraining pipe joints for a distance of at least 150 feet. Additional restraint may be provided on the HDPE pipe side in the form of an PVC anchor ring encased in concrete or other approved methods.

D. TRACER WIRE:
   1. The Contractor shall install, with the directionally drilled pipe, a 12 gauge copper clad steel locator wire with insulation suitable for direct burial. The tracer wire shall be as manufactured by Copperhead Industries, or equal. In rural areas, a test station shall be installed at approximately 1,000 foot intervals, near a fire hydrant or other structure that would fall closest to that interval. In built up urban areas, a station shall be provided at each intersection.

2.02 EQUIPMENT:

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe; a drilling fluid mixing, delivery and recovery system of sufficient capacity to successfully complete the crossing; a drilling fluid recycling system to remove solids from the drilling fluid so that the fluid can be re-used; a magnetic guidance system to accurately guide boring operations; a vacuum truck of sufficient capacity to handle the drilling fluid volume; and trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of this project.

c. Construction

3.01 ALIGNMENT AND PROFILE OPTIONS:

A. Alignment and profile shown on the drawings.

B. An alternate alignment and profile developed by the CONTRACTOR with the following requirements:
   1. Alignment must be within easement(s) and right-of-way.
   2. Clearance between utilities is maintained.
   3. 15 foot minimum vertical distance between the drill path and the bottom of a river to prevent drilling fluid breakout.
   4. ENGINEER approved.

3.02 PIPE FUSION

A. All pipe shall be joined with the "butt fusion" method in accordance with the pipe manufacturers recommendations. Socket fusion, extrusion welding, hot gas welding and mechanical connections are not acceptable.

B. Butt fusion joining shall produce a joint of equal or greater tensile strength than the strength of the pipe.

3.03 DRILL ENTRANCE AND EXIT PITS

A. The CONTRACTOR is responsible for the design and construction of the drill entrance and exit pits. Supports may be required to maintain safe working conditions. Ensure stability of the pit, minimize loosening, and minimize soil deterioration and disturbance of the surrounding ground.

B. Entrance and exit pits must be contained in the easement(s) and right-of way.

C. Drill entrance and exit pits must be maintained at minimum size to allow only the minimum amount of drilling fluid storage prior to transfer to mud recycling or processing system or for removal from the site.

D. Drilling fluid will not be allowed to freely flow on the site or around the entrance or exit pits. Fluid spilled must be removed as soon as possible and the ground restored to original condition.

E. Pits must be shored to OSHA standard if workers are required to enter the pits for any reason.

3.04 DRILL ENTRANCE AND EXIT ANGLES

A. Entrance and exit angles of the drill can be whatever the CONTRACTOR desires such that the elevation profile maintains adequate ground cover to ensure no drilling fluid breakout occurs and that ground exit occurs within the designated easement(s) or right- of-way. The CONTRACTOR is responsible for ensuring that entrance and exit angles ensure pullback forces do not exceed 5% strain on the polyethylene pipe.

3.05 GUIDANCE SYSTEM

A. The guidance system must have the capability of measuring inclination, roll and azimuth. The guidance system must have an independent means to ensure the accuracy of the installation. The CONTRACTOR will demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance system will be capable of generating a plot of the borehole survey for the purpose of an as-built drawing. The guidance system must meet the following specifications:

Inclination:	Range	-90º to +90º
	Accuracy	0.2º
Azimuth:	Range	0º to 360º
	Accuracy	0.5º
Roll:	Range	0º to 360º
	Accuracy	0.2º

3.06 PILOT HOLE TOLERANCES

A. The pilot hole shall be drilled along the agreed-to alignment and profile with the following tolerances:
   1. Vertical
      a. Plus 4 feet (deeper or additional ground cover).
      b. Minus 1 foot (shallower or reduced ground cover), except that the resulting pipe cover shall not be less than specified or indicated on the plans.
   2. Horizontal
      a. Plus or minus 2.5 feet.
   3. Curve radius
      a. Curve radius shall not exceed the pipe manufacturer's recommendations and that of the drilling equipment.

3.07 DRILL PATH DOCUMENTATION

A. The CONTRACTOR is responsible for maintaining drilling logs that provide drill path data every 25 feet along the drill path. Information logged every 25 feet will, at a minimum, include the following:
   1. Pilot hole
      a. Distance out or station
      b. Depth below a known ground surface elevation
      c. Plus or minus (left or right) of alignment
      d. Torque
      e. Drill fluid flow rate
      f. Time
   2. Back ream
      a. Distance out or station
      b. Pull back force
      c. Torque
      d. Drill fluid flow rate
      e. Time

3.08 PIPE GOUGING

A. The CONTRACTOR shall take every precaution to prevent gouging of the pipe prior to and during pipeline installation.

B. It is expected some pipe gouging will occur during pullback. However, the constructed pipeline shall not have any gouges that are deeper than 10% of the pipe wall thickness. Pipe that has gouges greater than 10% of the pipe wall thickness will not be accepted.

3.09 INSTALLING PRODUCT PIPE

A. After the pilot hole is completed, install a swivel to the reamer and commence pullback operations. Pre-reaming of the tunnel may be necessary and is at the option of the CONTRACTOR.

B. Reaming diameter will not exceed 1.4 times the diameter of the product pipe being installed.

C. Allow sufficient length of product pipe to extend past the termination point to allow connections to adjacent pipe sections or gate valves. Pulled pipes will be allowed 24 hours of stabilization prior to making tie-ins. The length of extra product pipe will be at the CONTRACTOR'S discretion.

D. Install an AWWA C153 Mechanical Joint Adaptor, per the manufacturer's requirements, when connecting the pipe to a valve or hydrant.

3.10 YIELD STRESS

A. The yield stress shall be calculated from the HDPE material submitted and the cross-sectional area of the pipe. The result will be the force at which the HDPE pipe will yield.

B. The pullback force will be monitored throughout the pullback. At no time shall the equipment be operated to produce a pullback force that exceeds 75% of the yield force.

3.11 CLEANUP

A. All excavated soil, soil cuttings and drilling fluid shall be the property of the CONTRACTOR. All material shall be disposed of in accordance with all laws, regulations, codes, ordinance and these specifications.

B. Immediately upon completion of the work in this section, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.

C. If a drilling fluid breakout should occur, the area shall be cleaned immediately and the surface washed and returned to original condition.

D. Every precaution shall be implemented to prevent a drilling fluid breakout in the river. It is the CONTRACTOR's responsibility to conduct construction activities to prevent this occurrence. However, if a drilling fluid breakout occurs in the river, it is the CONTRACTOR's responsibility to clean up any resultant contamination. The CONTRACTOR is also responsible for any damage to property or the environment due to such a breakout.

3.12 HYDROSTATIC TESTING

A. The pipe shall be hydrostatically tested before being connected to other piping systems. The pipe shall be tested independently of other hydrostatic tests.

B. Hydrostatic testing will consist of filling the constructed pipeline with water taking care to bleed off trapped air. The CONTRACTOR shall pressurize the pipe to 150 psi for a minimum of 4 hours to give the pipe time to expand. During this initial 4 hours, make-up water shall be added as-needed to maintain the pressure within 5 psi of the specified pressure. At the end of the first 4 hours, the pipe shall be pressurized to the specified pressure and the test commences. The pipeline shall be maintained under the test pressure for a continuous period of between 1 and 3 hours, as determined by the ENGINEER, by pumping water into the line at frequent intervals. The volume of water so added to maintain pressure within 5 psi of the specified pressure shall be measured and considered to represent the "leakage" from the line during the interval.

The allowable "leakage" for the pipeline shall not exceed the allowances given in the following table.

Nominal Pipe	**Allowable "Leakage" (Gal/100' of Pipe)**		
Size (In)	***1-Hour Test***	***2-Hour Test***	***3-Hour Test***
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
8	0.50	1.0	1.5
10	0.75	1.3	2.1
11	1.0	2.0	3.0
12	1.1	2.3	3.4
14	1.4	2.8	4.2
16	1.7	3.3	5.0
18	2.2	4.3	6.5
20	2.8	5.5	8.0
22	3.5	7.0	10.5
24	4.5	8.9	13.3
28	5.5	11.1	16.8
32	7.0	14.3	21.5
36	9.0	18.0	27.0
40	11.0	22.0	33.0
48	15.0	27.0	43.0

It is understood that the pipe will continue to expand after the initial 4 hours under pressure and throughout the 1 to 3-hour test period. The allowable "leakage" presented in the table above accounts for this expansion and no additional allowable "leakage" will be considered.

C. Under no circumstances shall the total time under the specified test pressure exceed 8 hours. If the test is not completed due to leakage, equipment failure, etc., the test shall be terminated and the pipeline shall be de-pressurized and permitted to "relax" for a minimum of 8 hours prior to the next testing sequences.

D. If there are no visual leaks or significant pressure drops during the final test period, and the measured "leakage" is less than allowable, the pipeline passes the hydrostatic test.

E. In the event that the "leakage", as determined by the ENGINEER, exceeds the specified allowable, the CONTRACTOR shall be responsible to repair or replace the pipeline until the pipeline passes the hydrostatic test, as determined by the ENGINEER.

3.13 TRACER WIRE

A. The Contractor shall install, with the directionally drilled pipe, a 12 gauge copper clad steel locator wire with insulation suitable for direct burial. In rural areas, a test station shall be installed at approximately 1,000 foot intervals, near a fire hydrant or other structure that would fall closest to that interval. In built up urban areas, a station shall be provided at each intersection. Tracer wire shall be installed with the directionally drilled pipe.

d. Measurement and Payment

The completed work items under HORIZONTAL DIRECTIONAL DRILLING will be measured in-place and paid for at the contract unit prices for the following contract items (pay items):

Contract Item (Pay Item)	Pay Unit
Water Main, C900 PVC,___inch, Bore	Foot

Water Main, C900 PVC,___inch, Bore, of the type, size, and detail as specified will be measured in-place per Foot, along centerline of the pipe, with no deductions for fittings. The price shall be payment in full for furnishing all material, labor, and equipment required to perform the work specified herein and shown on the plans including:

a. Flushing and disinfecting pipeline.

b. Furnishing and installing the pipe, fittings, gaskets, bracing or sheeting, blocking, restraints, temporary blow-offs, removal of existing water main inside influence area of work, and all other miscellaneous items necessary to complete the work.

c. No additional payment will be made for remedying an unsatisfactory hydrostatic test, including removing and replacing backfill.

d. Dewatering operations, for trench or pipe, will not be paid for separately, but will be included as part of major contract pay items of this provision.

e. The cost of excavation and proper disposal of material will not be paid for separately, but will be included as part of major contract pay items of this provision.
f. The cost of furnishing and compacting backfill material will not be paid for separately, but will be included as part of major contract pay items of this provision.
g. Removal or abandonment of existing water main, within the influence area of the proposed water main, will not be paid for separately, but will be included as part of major contract pay items of this provision.

END OF SECTION 33 05 07

SECTION 40 05 06 - COUPLINGS, ADAPTERS, AND SPECIALS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe penetrations.
   2. Restrained joints.
   3. Flexible connections.
   4. Expansion joints.
   5. Expansion loops.
   6. Sleeve-type couplings.

B. Related Requirements:
   1. Section 09 92 00 – Facility Painting: Product and execution requirements for painting specified by this Section.
   2. Section 40 05 07 - Hangers and Supports for Process Piping: Hangers, anchors, sleeves, and sealing of piping to adjacent structures.
   3. Section 40 05 19 - Ductile Iron Process Pipe: Ductile-iron piping materials and appurtenances.
   4. Section 40 05 51 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.

1.2 DEFINITIONS

A. Limit list of definitions to terms unique to this Section and not provided elsewhere.

B. FM: Factory Mutual Insurance Company; FM Global is the communicative name of the company.

1.3 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C219 - Bolted, Sleeve-Type Couplings for Plain-End Pipe.

B. American Welding Society:
   1. AWS D1.1/D1.1M - Structural Welding Code - Steel.

C. ASME International:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.
   2. ASME B31.3 - Process Piping.
   3. ASME B31.9 - Building Services Piping.
   4. ASME Boiler and Pressure Vessel Code (BPVC), Section IX - Welding, Brazing, and Fusing Qualifications.

D. Expansion Joint Manufacturers Association, Inc.:
   1. EJMA Standards.

E. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.4 COORDINATION

A. Section 01 31 00 - Project Management and Coordination: Requirements for coordination.

B. Coordinate Work of this Section with installation of valves and equipment.

1.5 PREINSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Requirements for preinstallation meeting.

1.6 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit manufacturer catalog information for each specified product.
   2. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length and wall thickness.
   3. Expansion Joints: Indicate maximum temperature, pressure rating, and expansion compensation.

C. Shop Drawings:
   1. Identification:
      a. Submit list of wording, symbols, letter size, and color coding for pipe identification.
      b. Comply with ASME A13.1.
   2. Indicate restrained joint details and materials.
   3. Submit layout drawings showing piece numbers and location, indicating restrained joint locations.
   4. Indicate layout of piping systems, including flexible connectors, expansion joints and compensators, loops, offsets, and swing joints.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS or ASME qualification within previous 12 months.

F. Manufacturer Instructions: Submit special procedures and setting dimensions.

G. Source Quality-Control Submittals: Indicate results of tests and inspections.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Requirements for submittals.

B. Section 01 78 39 - Project Record Documents: Requirement for recording actual locations of piping appurtenances.

C. Identify and describe unexpected variations to pipe routing or discovery of uncharted utilities.

1.8 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified to NSF Standards 61 and 372.

B. Coupling, adapters and special fittings: Manufactured in United States and in accordance with American Iron and Steel requirements

C. Perform Work according to ASME B31.9 for installation of piping systems and according to ASME BPVC-IX for welding materials and procedures.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience.

C. Welders: AWS or ASME qualified within previous 12 months for employed weld types.

D. Licensed Professional: Professional engineer experienced in design of specified Work and licensed in State of Michigan.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Furnish temporary end caps and closures on piping and fittings and maintain in place until installation.
   3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.12 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Requirements for warranties.

PART 2 - PRODUCTS

2.1 PIPE COUPLINGS FOR DUCTILE IRON, AND STEEL, AND STAINLESS STEEL PIPE

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. Dresser Industries, Style 38.
   2. Smith-Blair, Inc., 411.

B. Type: AWWA C219, bolted, gasketed sleeve-type.

C. Components:
   1. Center sleeve.
   2. End rings.
   3. Rubber compound, wedge-shaped gaskets suitable for configuration and service intended.
   4. Flanged coupling adapter where required; comply with AWWA C115.
   5. Fasteners: Trackhead steel bolts and nuts for aboveground service; stainless steel bolts and nuts for buried service.
   6. Coupling Material: Ductile iron, steel, or stainless steel as recommended by manufacturer based on pipe material.

D. Size and Configuration: As instructed by manufacturer based on pipe diameters.

E. If exposed piping and couplings will not be painted as part of this project, require factory applied epoxy coating.

F. Exterior Finish:
   a. Exposed Service: Factory-applied primer; comply with Section 09 92 00 – Facility Painting, for service condition.

G. Interior Finish:
   1. Water Service: Factory-applied epoxy coating; NSF 61-certified.

H. Use tie rods and tabs only when required.

I. Tie rods, tabs and fasteners; 304 stainless steel.

2.2 RESTRAINED FLANGE ADAPTER

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. EBAA Iron, Inc., Series 2100 Megaflange.
   2. Romac Industries RFCA

B. Material: Ductile iron and steel; comply with ASTM A536.

C. Coatings: Fusion bonded epoxy compliant with NSF 61.

D. Flange Bolts and Nuts: Type 304 stainless steel.

E. Bolt Circle: Comply with AWWA C115.

F. Restraint Device: Individually actuated gripping wedges, with torque-limiting actuating screws.

2.3 RESTRAINED DISMANTLING JOINT

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. Romac Industries, Model DJ400
   2. Smith-Blair Model 975

B. Material: Ductile iron and steel.

C. Coatings: Fusion bonded epoxy compliant with NSF 61.

D. Flange Bolts and Nuts: Type 304 stainless steel.

E. Bolt Circle: Comply with AWWA C115.

2.4 RESTRAINED RETAINER GLANDS

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. EBAA Iron Sales, Inc., MEGALUG Series 1100.
   2. ROMAGRIP Pipe Restraint

B. Materials: Gland body and wedges, ductile iron, ASTM A536.

C. Coatings: Fusion bonded epoxy or heat cured polyester.

D. Pressure Rating: Working pressure of 350 psi for 3-16 inch and 250 psi for 18-48 inch with a safety factor of 2:1

2.5 EXPANSION JOINTS

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. Garlock.
   2. General Rubber Corporation.
   3. Mercer Rubber Co.
   4. Red Valve Co.

B. Type: Single arch type.

C. Pressure Rating: 150 psi.

D. Tube: Single-piece, leak-proof, of synthetic or natural rubber based on service.

E. Water Service: NSF 61-certified.

F. Body: Multiple layers of fabric plies impregnated with rubber or synthetic compounds, reinforced with steel reinforcing rings. Provide rubber filler between reinforcing to prevent movement.

G. Cover: Synthetic or natural rubber.

H. Flange Rings: Split type; steel or ductile iron; ANSI B16.1.

I. Type 304 stainless steel for tie rods, tabs and fasteners.

J. Tie Rods: Provide tie rod assemblies for restraint of expansion joints on pump and blower discharges, and where shown on Drawings.

2.6 FLUSHING CONNECTIONS

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. Nibco, Inc., Fig. No. T-113-HC-LF.
   2. Crane LF-1320.

B. Type: Hose thread gate valve; 1.5 inch inlet; 1.5 inch hose thread outlet.

C. Body: Bronze or brass.

D. Trim: Bronze or brass.

E. Operator: Handwheel.

F. Accessories: Threaded adapter (if needed) to a male hose thread outlet and a hose cap with rubber gasket and brass safety chain.

2.7 PIPE SLEEVES

A. Material: Standard weight steel pipe or 18 gage galvanized steel.

B. Integral waterstop collar.

C. Size:
   1. Diameter: Large enough to allow for movement due to expansion and contraction. Allow for continuous insulation wrap.
   2. Length: Flush with wall or floor, unless otherwise indicated.

2.8 NON-MECHANICAL TYPE SEALS

A. Stuff opening between pipe and sleeve with glass fiber or mineral wool, non-combustible.

B. Caulk opening with sealant.

2.9 MECHANICAL TYPE SEAL

A. Manufacturers: Subject to compliance with the specified requirements, provide one of the following:
   1. GPT Industries, Link-Seal, Model S-316.

B. Type: Stainless Steel.

C. Design: Modular mechanical type, consisting of interlocking synthetic rubber links, shaped to fill the annular space between the pipe and sleeve.

D. Size: As instructed by manufacturer based on pipe size and opening size.

E. Sealing Element: EPDM (black), 50 Shore A Hardness.

F. Pressure Plate: Glass-reinforced nylon polymer.

G. Bolts and Nuts: Type 316 stainless steel.

2.10 FINISHES

A. Prepare piping appurtenances for field finishes as specified in Section 09 92 00 – Facility Painting.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Requirements for installation examination.

B. Verify that field dimensions are as indicated on Shop Drawings.

C. Inspect existing flanges for nonstandard bolthole configurations or design and verify that new pipe and flanges mate properly.

D. Verify that openings are ready to receive sleeves.

E. Verify that pipe plain ends to receive sleeve-type couplings are smooth and round for 12 inches from pipe ends.

F. Verify that pipe outside diameter conforms to sleeve manufacturer's requirements.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Requirements for installation preparation.

B. Cleaning: Thoroughly clean end connections before installation.

C. Close pipe and equipment openings with caps or plugs during installation.

D. Surface Preparation: Clean surfaces to remove foreign substances.

3.3 INSTALLATION

A. According to ASME B31.9.

B. Coating: Finish piping appurtenances as specified in Section 09 92 00 – Facility Painting for service conditions.

C. Pipe Penetrations:
   1. Sleeves:
      a. Exterior Watertight Entries: Seal with mechanical sleeve seals.
      b. Set sleeves in position in forms and provide reinforcement around sleeves.
      c. Size sleeves large enough to allow for movement due to expansion and contraction and provide for continuous insulation wrapping.
      d. Extend sleeves through floors 1-inch above finished floor level and caulk sleeves.
      e. Where piping penetrates floor, ceiling, or wall, close off space between pipe and adjacent Work with stuffing insulation and calk airtight.

D. Flexible Connections: Install flexible couplings at the following locations: connections to equipment, where indicated on Drawings or as recommended by equipment manufacturer.

E. Expansion Joints:
   1. Install expansion joints at the following locations: connections to equipment, where indicated on Drawings or as recommended by equipment manufacturer.
   2. If expansion joint is supplied with internal sleeve, indicate flow direction on outside of joint.

F. Air Release and Vacuum Breakers: Provide vacuum breakers as indicated on Drawings.

G. Disinfection: Disinfect potable water piping as specified in Section 33 13 00 - Disinfecting of Water Utility Distribution.

3.4 FIELD QUALITY CONTROL

A. Section 01 73 00 - Execution: Requirements for testing, adjusting, and balancing.

B. After installation, inspect for proper supports and interferences.

C. Repair damaged coatings with material equal to original coating.

3.5 CLEANING

A. Section 01 73 00 - Execution: Requirements for progress cleaning.

B. Section 01 77 00 – Closeout Procedures: Requirements for final cleaning.

C. Keep equipment interior clean as installation progresses.

END OF SECTION 40 05 06

SECTION 40 05 19 - DUCTILE IRON PROCESS PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Ductile-iron pipe.
   2. Ductile-iron, malleable-iron, and cast-iron fittings.
   3. Accessories.

B. Section does NOT include
   1. Buried ductile-iron pipe
   2. Buried ductile=iron, malleable-iron, or cast-iron fittings.
   3. Accessories for buried pipe.
   4. See municipality's standard water main specifications.

C. Related Requirements:
   1. Section 09 92 00 – Facility Painting: Product and execution requirements for painting specified by this
   2. Section. Section 10 14 00 – Identification Devices: Product and execution requirements for identification devices specified by this Section.
   3. Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping: Piping appurtenances.
   4. Section 40 05 07 - Hangers and Supports for Process Piping: Hangers, anchors, sleeves, and sealing of piping to adjacent structures.
   5. Section 40 05 51 - Common Requirements for Process Valves: Common product requirements for valves for placement by this Section.
   6. Section 40 05 64 – Butterfly Valves: Valve Installation
   7. Section 40 05 65 – Swing Check Valves: Valve Installation
   8. Section 43 23 21 – Centrifugal Water Pumps: Requirements for Wash Water Pumps

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
   3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings.
   4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   6. AWWA C150 - Thickness Design of Ductile-Iron Pipe.
   7. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
   8. AWWA C153 - Ductile-Iron Compact Fittings.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B31.3 - Process Piping.

C. ASTM International:
   1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.

D. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

E. Society for Protective Coatings:
   1. SSPC SP 6 - Commercial Blast Cleaning.

1.3 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for coordination.

B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.4 PREINSTALLATION MEETINGS

A. Section 01 31 00 - Project Management and Coordination: Requirements for preinstallation meeting.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information regarding pipe and fittings.

C. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 78 23 – Operation and Maintenance Data. Requirements for maintenance materials.

B. Tools: Furnish special wrenches, gages and other devices required for Owner to maintain fittings and appurtenances.

1.7 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Requirements for submittals.

B. Section 01 78 39 - Project Record Documents: Record actual locations of piping, valves and other appurtenances, connections, and elevations. Invert elevations shall be used for gravity applications and centerline elevations for pressure piping.

1.8 QUALITY ASSURANCE

A. Permanently mark each length of pipe with manufacturer's name or trademark and indicate conformance to standards.

B. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

C. The materials and methods of manufacture, and completed pipes and fittings are subject to inspection and rejection at all times. Owner and Engineer have the right to make inspections.

1.9 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience.

B. Installer: Company specializing in performing Work of this Section with minimum five years' experience.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Protect piping and appurtenances by storing off ground.
   3. Provide additional protection according to manufacturer instructions.

1.11 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Manufacturer List:
   1. American Cast Iron Pipe Company.
   2. Tyler Pipe & Coupling.
   3. U.S. Pipe.
   4. Substitutions: Specified in Section 01 60 00 – Product Requirements.

B. Piping:
   1. Comply with AWWA C115 for flanged pipe and AWWA C150 and AWWA C151 for mechanical joint or push on joint pipes.
   2. Buried:
      a. Designed in accordance with, minimum Thickness Class 52 and Pressure Class 350 with polyethylene encasement; manufactured in accordance with AWWA C151; mechanical joint or push-on joint per City of Owosso’s Special Provision for Water Main Installation.
   3. Exposed:
      a. Class 53 double lined cement interior piping with AWWA C115 flanged joint; AWWA C606 grooved joint shall be provided for process piping conveying water.
      b. Piping to be in compliance with NSF 61 and NSF 372 Drinking Water System Components.

C. Fittings:
   1. Material: AWWA C153 ductile iron.
   2. Same as that of connected piping.
   3. Restrained Joints: Comply with AWWA C111.
   4. Flanged Fittings: Comply with AWWA C110, AWWA C111 and ASME B16.1.

D. Joints
   1. Flanged: Appendix A of AWWA C115, and ANSI B16.1, Class 125; ductile iron flanges. Include AWWA C111 rubber gasket, ring or full face as required for the flange face. Gasket material shall be suitable for the intended service conditions and specifically designed for use with ductile iron pipe and fittings.
      a. Bolts: Comply with ANSI B18.2.1.
         1) Exposed: ASTM A307, Grade B and zinc plated.
         2) Buried, Submerged or Vapor Zone: ASTM A193, Grade B8M, Class 2, Heavy hex, Type 304 stainless steel.
      b. Nuts:
         1) Exposed: ASTM A563, Grade A, Heavy Hex and zinc plated.
         2) Buried, Submerged or Vapor Zone: ASTM A194, Grade B8M, Heavy hex, Type 304 stainless steel.
   2. Grooved End Joints
      a. Comply with ANSI/AWWA C606.
      b. Bolts and Nuts: For exposed service, carbon steel track bolts per ASTM A449 with heavy hex nuts per ASTM A563, both zinc electroplated per ASTM B633 ZN/FE5; for buried service, 316 stainless steel track bolts per ASTM F593 with 316 stainless steel heavy hex nuts per ASTM F594.
      c. Gaskets: ASTM D2000.
      d. Manufacturers: Victaulic Company of America, or as approved.
      e. Unless otherwise specified, grooved end couplings shall be rigid joint for exposed pipe and flexible joint for buried pipe.
   3. For bolted, gland and flange type joints, bolt length shall be such that all threads of the nut will be engaged.

E. Specials: Provide necessary transition pieces and pipe adapters for connections to existing piping and for joining pipe of different types.

F. Interior Lining:
   1. Cement-Mortar Lining:
      a. Comply with AWWA C104.
      b. Thickness: Double.

G. Outside Coating:
   1. Exposed Service:
      a. Primed with universal rust-inhibitive primer, 2.0 mils minimum thickness.
      b. Final coatings to be painted as specified in Section 09 92 00 – Facility Painting.
      c. For piping that is partially buried and penetrates a wall into an exposed area, entire pipe shall conform to coatings required for buried piping per the municipality's standard water main specification up to the first exposed interior joint. This section shall only apply to exposed interior pipe sections that are completely located in an interior space such as a building or vault.

H. Wall Castings:
   1. Ductile iron; AWWA C110; coated and lined as specified for pipe.
   2. Provide with integral water stop.
   3. End Connections: As indicated on Drawings.
   4. Length: As required for wall thickness.

I. Pipe, fittings and appurtenances: Manufactured in United States and in accordance with American Iron and Steel requirements.

2.2 ACCESSORIES

A. Taps and Plugs:
   1. Provide taps where shown or as required for small diameter piping or instrumentation connections.
   2. Required taps shall be furnished as part of this Work.
   3. Taps shall be temporarily plugged at point of fabrication.
   4. Where pipe wall thickness or tap diameter will not allow engagement of 3 full threads, provide tapping saddle.

B. Dielectric Fittings: Provide between dissimilar metals.

C. Grout
   1. Non-shrinking and non-corrosive; Five Star Grout by Five Star Products, Inc. Sealtight 588 Grout by W.R. Meadows, Inc**,** as approved**.**

D. Concrete
   1. Follow Section 03 30 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 73 00 - Execution: Requirements for installation examination.

B. Pipe and fittings will be inspected upon delivery to the jobsite. No cracked, broken or damaged pipe or fittings will be allowed in this Work.

C. Verify that field dimensions are as indicated on Shop Drawings.

D. Inspect existing flanges for nonstandard bolt hole configurations or design, and verify that new pipe and flange mate properly.

3.2 PREPARATION

A. Section 01 73 00 - Execution: Requirements for installation preparation.

B. Thoroughly clean pipe and fittings before installation.

C. Clean gaskets and all surfaces in contact with gaskets; comply with manufacturer’s instructions.

3.3 REMOVAL, MODIFICATION, AND ABANDONMENT OF EXISTING PIPING

A. Remove piping in a careful manner so as not to damage portions of the structures, equipment and piping that are to remain.

B. Piping removed and not reused subject to salvage by OWNER; place that salvaged by OWNER in storage on the Site as directed; dispose of that not salvaged by OWNER off of Site.

C. Remove concrete pipe supports and pipe hangers not to be reused. Remove remaining anchor bolts and reinforcing steel 1 inch below the surrounding surface.

D. Repair defaced surfaces and all other damage.

E. Provide adequate support for piping to remain in place; follow Section 13 53 0.

F. Modify piping as indicated and as required for proper connections.

G. Provide appropriate blind flanges, plugs, or caps for sealing remaining piping.

H. For abandoned buried piping, fill pipe for a minimum distance of 2 feet with Class II concrete; follow Section 03 30 00.

3.4 INSTALLATION

A. Exposed Service Piping:
   1. According to ASME B31.3.
   2. Run piping straight along alignment as indicated on Shop Drawings, with minimum number of joints.

B. Fittings:
   1. According to manufacturer instructions.
   2. Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.
   3. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; use torque wrench to tighten bolts to manufacturer instructions.
   4. All bolt threads shall be coated with anti-seize lubricant
   5. Provide required upstream and downstream clearances from devices as indicated on Drawings.

C. Make taps to ductile iron piping only with service saddle, tapping boss of a fitting or valve body, or equipment casting.

D. Install piping with sufficient slopes for venting or draining liquids and condensate to low points.

E. Support exposed piping as specified in Section 40 05 07 - Hangers and Supports for Process Piping.

F. Provide expansion joints as specified in Section 40 05 06 - Couplings, Adapters, and Specials for Process Piping, and pipe guides as specified in Section 40 05 07 - Hangers and Supports for Process Piping, to compensate for pipe expansion due to temperature differences.

G. Disinfect potable water piping as specified in this section.

H. Dielectric Fittings: Provide between dissimilar metals.

I. Field Cuts: According to pipe manufacturer instructions.

J. Finish primed surfaces according to Section 09 92 00 – Facility Painting.

3.5 CONNECTIONS TO EXISTING PIPING AND STRUCTURES

A. Provide opening in existing structure at proper location; insert pipe or wall casting, as indicated on Drawings; seal space between wall casting or pipe and opening with grout or mechanical seal as shown on the Drawings. .

B. Provide 24 hours' notice to ENGINEER and OWNER prior to making connection to existing piping.

C. Plan Work to reduce number of shut-offs and to minimize length of shut-off.

D. Make connections at such times and using fittings as approved by OWNER and ENGINEER.

E. A representative of OWNER shall operate existing valves. CONTRACTOR shall not operate existing valves.

F. When making connections to existing potable water mains, take extreme care to prevent contamination of existing mains. Before making connections, wash all fittings, valves, and pipe with clean water, and then disinfect by washing with a chlorine solution having a residual chlorine strength of not less than 50 ppm.

3.6 TOLERANCES

A. Section 01 40 00 - Quality Requirements: Requirements for tolerances.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Inspection:
1. Inspect for damage to pipe lining or coating and for other defects that may be detrimental as determined by Engineer.
2. Repair damaged piping or provide new, undamaged pipe.
3. After installation, inspect for proper supports and interferences.

C. Disinfection of Process Piping:
1. Prior to disinfection and hydrostatic testing, newly constructed water mains less than twenty-four (24) inches in diameter shall be thoroughly flushed to remove all accumulated debris that may have entered the line during construction.
2. After flushing, the water mains shall be chlorinated in accordance with AWWA C651 “Disinfecting Water Mains,” (latest revision).

Tablet Method:	Requires an average chlorine dose of approximately 25 ppm over 24 hours.
Continuous Feed Method:	Requires an initial concentration of 25 ppm and a residual of not less than 10 ppm after 24 hours.
Slug Method:	Requires an initial concentration of 100 ppm for at least 3 hours.

3. After the applicable retention period, heavily chlorinated water shall not remain in prolonged contact with the pipe. In order to prevent damage to the pipe lining or corrosion damage to the pipe itself, the heavily chlorinated water shall be flushed from the main until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system or is acceptable for domestic use.
4. The environment to which the chlorinated water is to be discharged shall be inspected. If there is any possibility that the chlorinated discharge will cause damage to the environment (in the opinion of the Engineer), a neutralizing chemical shall be applied to the water to be

wasted to thoroughly neutralize the residual chlorine. Where necessary and prior to any discharge, federal, state or local regulatory agencies shall be contacted to determine special provisions for the disposal of heavily chlorinated water.

5. After final flushing and before the new water main is connected to the distribution system, two consecutive sets of acceptable samples, taken at least twenty-four (24) hours apart shall be collected from the new main. At least one set of samples shall be collected from every 1,200 feet (366 meters) of the new water main, plus one set from the end of the line and at least one set from each branch. All samples shall be tested for bacteriological quality and shall show the absence of coliform organisms.
6. If this analysis shows the presence of harmful bacteria, the Contractor shall repeat the sterilization process until such time as the mains are shown to be sterile by the results of the bacteriological analysis. The Contractor shall dispose of high residual chlorine water by a method approved by the ENGINEER.
7. Mains twenty-four (24) inches in diameter and larger shall be chlorinated in sections between main line valves. Chlorine solution shall be renewed and transferred to the next adjacent section of pipe minimizing the volume of water needed to sterilize the main.

D. Pressure Testing:
   1. Test Pressure: As indicated on piping schedule.
   2. Conduct hydrostatic test for minimum two hours.
   3. Filling:
      a. Fill section to be tested with water slowly and expel air from piping at high points.
      b. Install corporation cocks at high points.
      c. Close air vents and corporation cocks after air is expelled.
      d. Raise pressure to specified test pressure.
   4. Observe joints, fittings, and valves under test.
   5. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage and retest.
   6. Leakage:
      a. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
      b. Maintain pressure within plus or minus 5 psi of test pressure.
      c. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
      d. Compute maximum allowable leakage by following formula:
         1) L = SD x sqrt(P)/C.
         2) L = testing allowance in gph.
         3) S = length of pipe tested in feet.
         4) D = nominal diameter of pipe in inches.
         5) P = average test pressure during hydrostatic test in psig.
         6) C = 148,000.
         7) If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
      e. If test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
      f. Correct visible leaks regardless of quantity of leakage.

3.8 CLEANING

A. Section 01 77 00 - Closeout Procedures specifies requirements for cleaning.

B. Keep pipe interior clean as installation progresses.

C. After installation, clean pipe interior of soil, grit, and other debris.

END OF SECTION 40 05 19

SECTION 40 05 51400551 - COMMON REQUIREMENTS FOR PROCESS VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Valves.
   2. Valve actuators.

B. Related Requirements:
   1. Section 01 60 00- Common Equipment Requirements:
   2. Section 03 30 00 - Cast-in-Place Concrete: Execution requirements for placement of concrete as required by this Section.
   3. Section 09 92 00 – Facility Painting: Product and execution requirements for painting specified by this Section.
   4. Section 10 14 00 – Identification Devices: Product and execution requirements for identification specified by this Section
   5. Section 26 05 03 - Equipment Wiring Connections: Electrical connections for equipment specified in this Section.
   6. Section 40 05 07 - Hangers and Supports for Process Piping: Product and execution requirements for valve supports specified by this Section.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C541 - Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
   2. AWWA C542 - Electric Motor Actuators for Valves and Slide Gates.
   3. AWWA C550 - Protective Interior Coatings for Valves and Hydrants.

B. ASTM International:
   1. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   2. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

C. Manufacturers Standardization Society:
   1. MSS SP-25 - Standard Marking System for Valves, Fittings, Flanges, and Unions.

D. National Electrical Manufacturers Association:
   1. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

E. NFPA:
   1. NFPA 70 - National Electrical Code (NEC).

F. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

G. UL:
   1. Equipment Directory.

1.3 COORDINATION

A. Section 01 31 00 - Project Management and Coordination: Requirements for coordination.

B. Coordinate Work of this Section with piping, equipment, and appurtenances.

1.4 PREINSTALLATION MEETINGS

A. Section 01 31 00 - Project Management and Coordination: Requirements for preinstallation meeting.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit manufacturer information for actuator with model number and size indicated.
   2. Submit valve cavitation limits.

C. Shop Drawings: Indicate parts list, materials, sizes, position indicators, limit switches, control system, actuator mounting, wiring diagrams, and control system schematics.

D. Valve-Labeling Schedule: Indicate valve locations and nametag text.

E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

F. Manufacturer Instructions: Submit installation instructions and special requirements.

G. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

H. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections, including factory-applied coatings.

I. Manufacturer Reports: Certify that [equipment has been installed according to manufacturer instructions.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Requirements for submittals.

B. Section 01 78 23 – Operation and Maintenance Data: Requirements for O&M Manuals.

C. Section 01 78 39 - Project Record Documents: Record actual locations of valves and actuators.

1.7 QUALITY ASSURANCE

A. Maintain clearances as indicated on Drawings and Shop Drawings.

B. Ensure that materials of construction of wetted parts are compatible with process liquid.

C. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Protect valve ends from entry of foreign materials by providing temporary covers and plugs.
   3. Provide additional protection according to manufacturer instructions.

1.10 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

A. Section 01 77 00 – Closeout Procedures: Requirements for warranties.

PART 2 - PRODUCTS

2.1 VALVES

A. Description: Valves, operator, actuator, handwheel, chainwheel, extension stem, floor stand, worm and gear operator, operating nut, chain, wrench, and other accessories as required.

B. Valve Ends: Compatible with adjacent piping system.

C. Operation:
   1. Exposed process valves - Open by turning left (clockwise), close by turning right (clockwise).
   2. Cast directional arrow on valve or actuator with OPEN and CLOSE cast on valve in appropriate location.

D. Valve Marking and Labeling:
   1. Marking: Comply with MSS SP-25.
   2. Labeling: As specified in Section 40 05 13 - Common Work Results for Process Piping and valve schedule.

E. Valve Construction:

1. Bodies: Rated for maximum temperature and pressure to which valve will be subjected as specified in valve Sections.
2. Bonnets:
   a. Flanged to body and of same material and pressure rating as body.
   b. Furnish glands, packing nuts, or yokes as specified in valve Sections.
3. Stems and Stem Guides:
   a. Materials and Seals: As specified in valve Sections.
   b. Bronze Valve Stems: According to ASTM B62.
   c. Space stem guides 10 feet o.c.
   d. Submerged Stem Guides: Type 304 stainless steel.
4. Nuts and Bolts: As specified in Section 05 50 00 - Metal Fabrications.

2.2 VALVE ACTUATORS

A. Provide actuators with position indicators for shutoff valves 6 inches and larger.

B. Comply with AWWA C541.

C. Provide chain actuators for shutoff valves mounted 7 feet above operating floor level.

D. Provide gear and power actuators with position indicators.

E. Gear-Assisted Manual Actuators:
   1. Provide totally enclosed gears.
   2. Maximum Operating Force: 60 lbf.
   3. Bearings: Permanently lubricated bronze.
   4. Packing: Accessible for adjustment without requiring removal of actuator from valve.

F. Chain Actuator:
   1. Description: Chain guides and stainless steel operating chain extending to 5-1/2 feet above operating floor level.
   2. Chain Wheels: Sprocket-rim type.
   3. Furnish chain storage if chains may interfere with pedestrian traffic.

G. Valve Actuators in NEC Class I, Group D, Division 1 or 2 Hazardous Locations: UL approved.

H. Accessories:
   1. Handwheel:
      a. Furnish permanently attached handwheel for emergency manual operation.
      b. Rotation: None during powered operation.
      c. Permanently affix directional arrow and cast CLOSE on handwheel to indicate appropriate direction to turn handwheel.
      d. Maximum Operating Force: 60 lbf.

2.3 FINISHES

A. Valve Lining and Coating: Comply with AWWA C550 and NSF 61 and 372.

B. Exposed Valves: As specified in Section 09 92 00 – Facility Painting.

C. Do not coat flange faces of valves unless otherwise specified.

2.4 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing: Test valves according to manufacturer's standard testing protocol, including hydrostatic, seal, and performance testing.

C. Certificate of Compliance:
   1. Manufacturer to submit certificate of compliance with American Iron and Steel requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for installation examination.

B. Verify that piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves, actuators, extensions, valve boxes, and accessories according to manufacturer instructions.

B. Firmly support valves to avoid undue stresses on piping.

C. Coat studs, bolts and nuts with anti-seizing lubricant.

D. Clean field welds of slag and splatter to provide a smooth surface.

E. Install valves with stems upright or horizontal, not inverted.

F. Install brass male adapters on each side of valves in copper-piped system and solder adapters to pipe.

G. Install 3/4-inch ball valves with cap for drains at main shutoff valves, low points of piping, bases of vertical risers, and equipment.

H. Install valves with clearance for installation of insulation and to allow access.

I. Provide access where valves and fittings are not accessible.

J. Pipe Hangers and Supports: As specified on contract drawings.

K. Valve Applications:
   1. Install shutoff and drain valves at locations as indicated on Drawings and as specified in this Section.
   2. Install shutoff and isolation valves.
   3. Isolate equipment, part of systems, or vertical risers as indicated on Drawings.
   4. Install valves for throttling, bypass, or manual flow control services as indicated on Drawings.
   5. Install, butterfly, and gate valves in water systems for shutoff service.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Valve Field Testing:
   1. Test for proper alignment.
   2. If specified by valve Section, field test equipment to demonstrate operation without undue noise, vibration, or overheating.
   3. Engineer will witness field testing.

END OF SECTION 40 05 51400551

SECTION 40 05 53 - IDENTIFICATION FOR PROCESS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Nameplates.
   2. Tags.
   3. Stencils.
   4. Pipe markers.
   5. Ceiling tacks.
   6. Labels.
   7. Lockout devices.

B. Related Requirements:
   1. Section 09 92 00 – Facility Painting: Execution requirements for painting specified by this Section.
   2. Division 40 – Process Integration.
   3. Division 43 – Process Equipment.

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
   1. ASME A13.1 - Scheme for the Identification of Piping Systems.

1.3 PREINSTALLATION MEETINGS

A. Section 01 31 00 – Project Management and Coordination: Requirements for preinstallation meeting.

B. Convene minimum one week prior to commencing Work of this Section.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer's catalog literature for each product required.

C. Shop Drawings: Submit list of wording, symbols, letter size, and color-coding for mechanical identification and valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Samples: Submit two tags for each size used on Project.

E. Manufacturer's Installation Instructions: Indicate installation instructions, special procedures, and installation.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Qualifications Statement:
   1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Requirements for closeout procedures.

B. Project Record Documents: Record actual locations of tagged valves; include valve tag numbers.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 01 78 23 - Execution and Closeout Requirements: Requirements for maintenance materials.

B. Extra Stock Materials: Furnish two containers of spray-on adhesive.

C. Tools: Furnish special crimpers and other devices required for Owner to reinstall tags.

1.7 QUALITY ASSURANCE

A. Conform to ASME A13.1 for color scheme for identification of piping systems and accessories.

B. Perform Work according to applicable standards.

C. Maintain 2 copies of each standard affecting the Work of this Section on-site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

PART 2 - PRODUCTS

2.1 NAMEPLATES

A. Manufacturers:
   1. Craftmark Pipe Markers
   2. Kolbi Pipe Marker Co.
   3. Pipemarker.com
   4. Seton Identification Products

B. Description: Laminated three-layer plastic with engraved black letters on light, contrasting background color.

2.2 TAGS

A. Plastic Tags:
   1. Manufacturers:
      a. Brady ID
      b. Craftmark Pipe Markers
      c. Kolbi Pipe Marker Co.
      d. Marking Services, Inc
      e. R&R Identification Co.
      f. Seton Identification Products
   2. Description:

a. Laminated three-layer plastic with engraved black letters on light, contrasting background color.
b. Minimum Tag Size and Configuration: 1-1/2 inches; diameter.

B. Metal Tags:
1. Manufacturers:
a. Brady ID
b. Craftmark Pipe Markers
c. Kolbi Pipe Marker Co.
d. Marking Services, Inc
e. R&R Identification Co.
f. Seton Identification Products
2. Description:
a. Aluminum construction; stamped letters.
b. Minimum Tag Size and Configuration: 1-1/2 inches; diameter with finished edges.

C. Information Tags:
1. Manufacturers:
a. Brady ID
b. Seton Identification Products
2. Description:
a. Clear plastic with printed WARNING and message.
b. Minimum Tag Size: 3-1/4 by 5-5/8 inch.
c. Furnish grommet and self-locking nylon ties.
3. Tag Chart: Typewritten, letter-size list of applied tags and location, in anodized aluminum frame or plastic laminated, depending on building's hazardous classification.

2.3 STENCILS

A. Manufacturers:
1. Kolbi Pipe Marker Co..
2. Marking Services, Inc.
3. Pipemarker.com
4. R&R Identification Co.
5. Seton Identification Products

B. Description:
1. Clean-cut symbols.
2. Letters:
a. Up to 2-inch Outside Diameter of Insulation or Pipe: 1/2-inch-high letters.
b. 2-1/2- to 6-inch Outside Diameter of Insulation or Pipe: 1-inch-high letters.
c. Over 6-inch Outside Diameter of Insulation or Pipe: 1-3/4-inch-high letters.

C. Color-Coding and Lettering Size: Conform to ASME A13.1.

2.4 PIPE MARKERS

A. Color-Coding and Lettering Size: Conform to ASME A13.1.

B. Plastic Pipe Markers:
1. Manufacturers:
a. Brady ID
b. Craftmark Pipe Markers
c. Marking Services, Inc
d. R&R Identification Co.

e. Seton Identification Products
2. Description:
a. Factory-fabricated, flexible, semirigid plastic.
b. Preformed to fit around pipe or pipe covering.
c. Larger sizes may have maximum sheet size with spring fastener.

C. Plastic Tape Pipe Markers:
1. Manufacturers:
a. Brady ID
b. Craftmark Pipe Markers
c. Kolbi Pipe Marker Co.
d. Marking Services, Inc
e. Pipemarker.com
f. Seton Identification Products
2. Description: Flexible, vinyl film tape with pressure-sensitive adhesive backing and printed markings.

D. Plastic Underground Pipe Markers:
1. Manufacturers:
a. Kolbi Pipe Marker Co.
b. Marking Services, Inc
c. Pipemarker.com
d. Rhino Marking and Protection
e. Seton Identification Products
2. Description:
a. Brightly colored, continuously printed plastic ribbon tape.
b. Minimum 6 inches wide by 4 mil thick.
c. Manufactured for direct burial service.

2.5 CEILING TACKS

A. Manufacturers:
1. Marking Services, Inc.
2. R&R Identification Co.
3. Seton Identification Products

B. Description:
1. Steel construction.
2. Head: 3/4-inch diameter; color coded.

C. Color-Coding and Lettering Size: Conform to ASME A13.1.

2.6 LABELS

A. Manufacturers:
1. Brady ID.
2. Seton Identification Products

B. Description:
1. Aluminum construction.
2. Minimum Size: 1.9 by 0.75 inches.
3. Adhesive backed, with printed identification.

2.7 LOCKOUT DEVICES

A. Lockout Hasps:
   1. Manufacturers:
      a. Brady ID.
      b. Master Lock Company, LLC
   2. Description:
      a. Anodized aluminum construction.
      b. Furnish hasp with erasable label surface.
      c. Minimum Size: 7-1/4 by 3 inches.

B. Valve Lockout Devices:
   1. Manufacturers:
      a. Brady ID.
      b. Master Lock Company, LLC
   2. Description:
      a. Plastic construction.
      b. Furnish device preventing access to valve operator and accepting lock shackle.

PART 3 - EXECUTION

3.1 PREPARATION

A. Section 01 77 00 - Closeout Procedures: Requirements for installation preparation.

B. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Apply stencil painting as specified in Section 09 92 00 – Facility Painting.

B. Install identifying devices after completion of coverings and painting.

C. Install plastic nameplates with corrosion-resistant mechanical fasteners or adhesive.

D. Labels:
   1. Install labels with sufficient adhesive for permanent adhesion and seal with clear lacquer.
   2. For unfinished covering, apply paint primer before applying labels.

E. Tags:
   1. Install tags using corrosion-resistant chain.
   2. Number tags as indicated in tag schedule.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Identify valves in main and branch piping with tags.

H. Piping:
   1. Identify piping, concealed or exposed, with plastic pipe markers.
   2. Use tags on piping 3/4-inch diameter and smaller.
   3. Identify service, flow direction, and pressure.
   4. Install in clear view and align with axis of piping.

5. Locate identification not to exceed 20 feet on straight runs, including risers and drops, adjacent to each valve and tee, at each side of penetration of structure or enclosure, and at each obstruction.

I. Ceiling Tacks:
   1. Provide ceiling tacks to locate valves above T-bar-type panel ceilings.
   2. Locate in corner of ceiling panel closest to equipment.

3.3 ATTACHMENTS

A. Identification: As indicated on Drawings. See Schedule.

B. Valve Tags: As indicated on Drawings. See Schedule.

END OF SECTION 40 05 53

SECTION 40 05 61 - GATE VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Exposed resilient-seated gate valves in buildings and vaults.

B. Section does NOT include
   1. Buried valves, valves in gatewells, gatewell structures, manhole structures, or thrust blocks. See municipality's standard water main specifications.

C. Related Requirements:
   1. Section 40 05 51 – Common requirements for Process Valves

1.2 REFERENCE STANDARDS

A. American Society of Mechanical Engineers:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
   2. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.
   3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
   4. ASME B1.20.1 - Pipe Threads, General Purpose (Inch.
   5. ASME B1.20.2 - Pipe Threads, 60 deg. General Purpose (Metric).

B. ASTM International:
   1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   3. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.
   4. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.

C. American Water Works Association:
   1. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service.

D. Manufacturers Standardization Society of the Valve and Fittings Industry:
   1. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends.
   2. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data:
   1. Submit catalog information, indicating materials of construction and compliance with indicated standards.

C. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

PART 2 - PRODUCTS

2.1 RESILIENT-SEATED GATE VALVES

A. Manufacturers:
   1. East Jordan Iron Works.
   2. Mueller
   3. Kennedy Valve
   4. M&H Valve

B. Description:
   1. AWWA C515.
   2. Minimum Working Pressure: 200 psig.
   3. Maximum Fluid Temperature: 125 degrees F.
   4. End Connections:
      a. Flanged: Comply with ASME B16.1, ASME B16.5, ASME B16.42.

C. Operation:
   1. Handwheel.

D. Materials:
   1. Wedge: Resilient ASTM A536, fully encapsulated with molded rubber.
   2. Body and Disc: ASTM A536, ductile iron, rubber coated.
   3. Stem, Stem Nuts, Glands, and Bushings: ASTM B584, bronze.
   4. Connecting Hardware: Type 316 stainless steel.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing: Test gate valves according to AWWA C515.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install according to manufacturer's instructions.

B. Support valves in plastic piping to prevent undue stresses on piping.

END OF SECTION 40 05 61

SECTION 40 05 65.23 - CHECK VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Swing check valves and “Silent” check valves 3 inches and larger.

B. Related Requirements:
   1. Section 40 05 51 - Common Requirements for Process Valves: Basic materials and methods related to valves commonly used for process systems.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   2. ASME B16.11 - Forged Fittings, Socket-Welding and Threaded.
   3. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.

C. ASTM International:
   1. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   2. ASTM A536 - Standard Specification for Ductile Iron Castings.
   3. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings.
   4. ASTM B148 - Standard Specification for Aluminum-Bronze Sand Castings.

D. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

E. SSPC - The Society for Protective Coatings:
   1. SSPC-SP 6 - Commercial Blast Cleaning.

1.3 COORDINATION

A. Coordinate Work of this Section with piping and equipment connections specified in other Sections and as indicated on Drawings.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit catalog information, indicating materials of construction and compliance with indicated standards.

C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 73 00 - Execution and Section 01 77 00 - Closeout Procedures: Requirements for submittals.

1.6 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 10 years' experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Protect piping and appurtenances by storing off ground.
   3. Provide additional protection according to manufacturer instructions.

1.9 EXISTING CONDITIONS

A. Field Measurements:
   1. Verify field measurements prior to fabrication.
   2. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 SWING CHECK VALVES

A. Manufacturers:
   1. Kennedy Valve.
   2. M&H Valve Company.
   3. Golden Anderson, Inc.

B. Description:
   1. Type: Swing, resilient seated, with outside lever and adjustable weight.
   2. Size: 3 inches and larger.
   3. Comply with AWWA C508.
   4. Minimum Working Pressure: 200 psi for valves 12 inches and smaller; 150 psi for valves 14 inches and larger.
   5. Maximum Fluid Temperature: 125 degrees F.
   6. Flow Area: Full open, equal to connecting nominal pipe diameter.
   7. Mounting: Horizontal or vertical.

8. End Connections: Flanged, ASME B16.1.

C. Materials:
1. Body, Disc and Cover: Cast iron, ASTM A126 or Ductile iron, ASTM A536.
2. Seat: Field replaceable, .Resilient-to-Metal.
3. Chamber and Plunger: Bronze, ASTM B62or 316 SS..
4. Hinge Pin and Key: Stainless steel.
5. Packing and O-Ring: Buna-N.
6. Rubber Components: Buna-N.
7. Connecting Hardware: Type 304 stainless steel.

D. Finishes: As specified in Section 40 05 51 - Common Requirements for Process Valves.

2.2 SILENT CHECK VALVES

A. Manufacturers:
1. Val-Matic #1800A
2. APCO (DeZurik) 600A

B. Description:
1. Type: Globe style, center guided, spring loaded disc and having a short linear stroke
2. Flow area: Area through valve shall be equal to or exceed flow area through pipe
3. Mounting: horizontal or vertical installation; see drawings
4. Connection: Class 125 Flanges

C. Materials
1. Body: Cast iron; ASTM A126, Grade B or Ductile iron, ASTM A536 Grade 65-45-12.
2. Disc: ASTM B584 Alloy C87600 lead-free bronze or 316 stainless steel: center guided at both ends; spring-loaded.
3. Spring and trim: 316 Stainless steel.
4. Seat: Resilient material suitable for the service intended.
5. Lining and coating: NSF/ANSI certified epoxy in accordance with AWWA C550.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing:
1. Hydrostatically test check valves at twice rated pressure according to AWWA C508.
2. Permitted Leakage at Indicated Working Pressure: None.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field dimensions are as indicated on Drawings.

B. Inspect existing flanges for nonstandard bolt-hole configurations or design, and verify that new valve and flange mate properly.

3.2 PREPARATION

A. Thoroughly clean valves before installation.

B. Surface Preparation:

1. Touch up shop-primed surfaces with primer as specified in Section 09 92 00 – Facility Painting.

3.3 INSTALLATION

A. According to AWWA C508 and manufacturer instructions.

B. Install valves so that levers can freely move without interfering with access to other valves, piping, structures and equipment.

C. Dielectric Fittings: Provide between dissimilar metals.

3.4 FIELD QUALITY CONTROL

A. Inspection:
   1. Inspect for damage to valve lining or coating and for other defects that may be detrimental as determined by Architect/Engineer.
   2. Repair damaged valve or provide new, undamaged valve.
   3. After installation, inspect for proper supports and interferences.

B. Field Tests:

   1. Adjust all parts and components as required to provide correct operation of valves.
   2. Conduct functional field test on each valve in presence of Engineer to demonstrate that each valve operates correctly.

C. Pressure test valves with piping.

3.5 CLEANING

A. Keep valve interior clean as installation progresses.

B. After installation, clean valve interior of soil, grit, loose mortar, and other debris.

END OF SECTION 40 05 65.23

SECTION 40 71 13 - MAGNETIC FLOW METERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Magnetic flow meters.
   2. Transmitters.
   3. Indicators.
   4. Recorders.
   5. Integrators.

B. Related Requirements:
   1. Section 26 05 23 - Control-Voltage Electrical Power Cables: Control power wiring requirements.

1.2 REFERENCE STANDARDS

A. American Water Works Association:
   1. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.
   2. AWWA M33 - Flowmeters in Water Supply.

B. ASME International:
   1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.

C. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for coordination.

B. Coordinate Work of this Section with piping Work.

1.4 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for system materials and component equipment, including connection requirements.

C. Shop Drawings:
   1. Indicate system materials and component equipment.
   2. Submit installation requirements and other details.
   3. List of spare parts and optional equipment.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of shop tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports:
   1. Certify that equipment has been installed according to manufacturer instructions.
   2. Indicate activities on Site, adverse findings, and recommendations.

H. Qualifications Statement:
   1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Requirements for submittals.

B. Section 01 78 23 – Operation and Maintenance Data: Requirements for O&M manuals.

C. Section 01 78 39 - Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.6 QUALITY ASSURANCE

A. Ensure that materials of construction of wetted parts are compatible with process liquid.

B. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 20 years' documented experience.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store equipment according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.9 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for magnetic flow meters and appurtenant devices.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Furnish sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, interconnecting cables, and unit conversions and algorithms as required for application.

2.2 MAGNETIC FLOW METERS

A. Furnish sensors, field preamplifiers, signal conditioners, offset and span adjustments, amplifiers, transducers, transmitters, control devices, interconnecting cables, and unit conversions and algorithms as required for application.

B. Manufacturers:
   1. ABB
   2. Endress and Hauser
   3. Honeywell, Inc.
   4. Johnson Yokogawa Corp.
   5. Krohne America
   6. Rosemount

C. Flow Rate Range:
   1. Expectant flow ranges for the meters
      a. 0-1500 gpm
   2. Meters shall be capable of meter in the ranges indicated and ±20% above and below the expectant ranges.

D. Size: As indicated in on Drawings or in Schedule.

E. Flow Tubes:
   1. Material:
      a. Liner to be NSF 61 Compliant
   2. Length: Manufacturers standard length for diameter specified.
   3. End Connections:
      a. Class 125 Flange

F. Performance and Design Criteria:
   1. Design: According to AWWA M33

G. Electrodes:
   1. Type Hastalloy C
   2. Self-cleaning or flush for clean fluids.

H. Performance
   1. Plus or minus 0.5 percent of actual flow rate over a 30:1 range.
   2. Internal meter verification
   3. Process diagnostics, coating diagnostics and ground loop verification.
   4. 3 Point calibration with pressure test traceable to NIST standards

I. Provide adjustment for zero and span.

J. Accessories:
   1. Furnish cable between the transmitter and receiver.

2. Provide software or any cables needed for communication or meter verification

K. Meters 1/10 through four inch shall be wafer style or as indicated on the Drawings. Flangeless meters shall be designed for installation between 150 class or 300 class ANSI, DIN, or BS pipe flanges. Flangeless meters shall have a tefzel liner and zirconium or platinum electrodes. Meters six inches or larger shall be flanged design, ASME B16.1, carbon steel.

L. Meter shall be capable of withstanding accidental submergence in up to 30 feet of water for up to 48 hours without damage. Field coil design shall be such that they shall not overheat or otherwise be damaged if flow tube is not totally filled with fluid. Magmeters shall be furnished with two 316 stainless-steel grounding rings.

M. The sensing element shall be constructed of suitable materials to withstand submergence to 30 feet to IP 68 rating indefinitely. The tube shall be designed so that it may be buried to a depth of 15 feet where applicable. Provide evidence of ability to be buried. Directions for installation of conduit and wiring connections shall be clearly written and graphically shown for installer's use.

N. Magnetic flowmeter signal converter shall consist of solid-state, feedback-type microprocessor circuitry. Operational parameters shall be used configurable locally via an integral push-button arrangement or via a remote intelligent terminal.

O. Where indicated on Drawings, a high frequency digital proportional output shall be provided for use with high accuracy totalizers. To eliminate errors, the converter shall incorporate an integral zero return circuit to provide a constant zero output signal in response to an external dry contact closure. An automatic empty pipe detector and low-flow cutoff shall be provided as standard.

P. Description: Low-frequency, electromagnetic induction-type flow meter, producing a linear signal directly proportional to flow rate, consisting of flow tube, signal cable, and transmitter.

2.3 TRANSMITTERS

A. Transmitter Output:
   1. 4- to 20-mA dc analog signal.
   2. Accuracy: Plus or minus 0.5 percent of full scale.
   3. Display flow rate and totalized flow.

B. Housing Material: Cast aluminum.

C. HMI:
   1. Touch-screen programming, functioning through enclosure window without opening enclosure or integral keypad.
   2. Display:
      a. Size: Three (minimum) lines.
      b. Type: Backlit digital display.
      c. User-selectable engineering units.
      d. Readout of diagnostic error messages.

D. Mounting:
   1. Mount on flow tube unless otherwise indicated on drawings

E. Transmitter Communication Interface: HART.

F. Communication Firmware and Software: Manufacturer's current.

G. Accessories:
   1. Current signal output simulation.
   2. Empty pipe detection.
   3. Self-diagnostics.
   4. Automatic zero adjustment.
   5. Signal Cable: Provided by flow meter manufacturer, minimum 60 feet or as required in Schedule

2.4 INDICATORS

A. Description:
   1. Integrally mounted in transmitter housing.
   2. Scale: Graduated.
   3. Length: As indicated on Drawings.
   4. Units: gpm.
   5. Mounting: Remote

2.5 OPERATION

A. Control Power:
   1. Wiring: As specified in Section 26 05 03 - Equipment Wiring Connections.
   2. 120-V ac, single phase, 60 Hz.
   3. Furnish local transformers as required.

B. Enclosures: NEMA 4X.

2.6 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of meters according to AWWA M6.

C. Certificate of Compliance:
   1. If manufacturer is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at manufacturer's facility conforms to Contract Documents.
   2. Specified shop tests are not required for Work performed by approved manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 31 00 – Project Management and Coordination: Requirements for pre-installation conference.

B. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. Coordinate location and orientation of flow meter with final equipment installations.

B. Ensure that instruments are located to be easily accessible for maintenance. Install products in accordance with manufacturer’s written instruction and in compliance with recognized industry practices to ensure that products fulfill requirements.

C. Elements that are supported by plumbing or piping, or that have only plumbing or piping connections shall be installed under those Sections.

D. Plumbing, piping or pneumatic signal connections to elements requiring such connections shall be made under those Sections. Control panels will be installed in accordance with Division 33 with piping connections to control panels being made under Division 40.

E. Drawings: Drawings are not intended to show every detail of construction or location of piping, conduit or equipment. Where proper operation or construction makes it necessary or advisable to change location of piping, instrumentation equipment or other equipment, Contractor shall so inform Engineer for approval and permission.

F. Ensure that products are installed plumb and true, free of warp or twist, within tolerances specified by the manufacturer and as indicated in the contract documents.

G. Wiring between flow sensors and remote mounted signal converters shall use cable type and procedures as per the manufacturer's recommendations

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 73 00 - Execution: Requirements for testing, adjusting, and balancing.

C. Testing:
   1. Test and calibrate flow meter to demonstrate that it meets specified accuracy requirements.
   2. Comply with AWWA M6.

D. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 8 hours on Site for installation, inspection, startup, field testing, and instructing Owner's personnel in operation and maintenance of equipment.

E. Equipment Acceptance:
   1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
   2. Make final adjustments to equipment under direction of manufacturer's representative.

F. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

3.4 DEMONSTRATION

A. Section 01 79 00 – Demonstration and Training: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 40 71 13

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SECTION 40 72 43 - PRESSURE AND DIFFERENTIAL PRESSURE TYPE LEVEL METERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Pipe Mounted Hydrostatic-level measurement devices
   2. Pressure Transmitters
   3. Differential Pressure Transmitters
   4. Submersible Hydrostatic-level measurement devices.

B. Related Requirements:
   1. Section 26 05 23 – Control-Voltage Electrical Power Cables: Control power wiring requirements.

1.2 REFERENCE STANDARDS

A. International Electrotechnical Commission:
   1. IEC 61508 - Functional safety of electrical/electronic/programmable electronic safety-related systems.
   2. IEC 61511 - Corrigendum 1 - Functional safety - Safety instrumented systems for the process industry sector.

B. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for system materials and component equipment, including connection requirements.

C. Shop Drawings:
   1. Indicate system materials and component equipment.
   2. Submit installation requirements and other details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Manufacturer Reports: Certify that equipment has been installed according to manufacturer instructions.

H. Qualifications Statement:
   1. Submit qualifications for manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Section 01 77 00 - Closeout Procedures: Requirements for closeout procedures.

B. Section 01 78 23 – Operation and Maintenance: Requirements for O&M manuals.

C. Section 01 78 39 - Project Record Documents: Record actual locations and final orientation of equipment and accessories.

1.5 QUALITY ASSURANCE

A. Ensure that materials of construction of wetted parts are compatible with process liquid.

B. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 20 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

C. Store materials according to manufacturer instructions.

D. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

1.8 WARRANTY

A. Section 01 77 00 - Closeout Procedures: Requirements for warranties.

B. Furnish five-year manufacturer's warranty for measurement devices.

PART 2 - PRODUCTS

2.1 PIPE MOUNTED MEASUREMENT DEVICES

A. Manufacturers:
   1. ABB
   2. Rosemount
   3. Endress and Hauser
   4. Honeywell
   5. Substitutions: As specified in Section 01 60 00 - Product Requirements.

B. Body

1. Enclosure Type NEMA 4x rated
2. Pressure and Pressure Type Level units shall be furnished with stainless steel two valve manifold assembly
3. Differential pressure units shall be furnished with close coupled stainless steel three valve manifold assembly.

C. Sensor:
1. Description: Pressure sensor, condensate proofed and long-term stable, and incorporating continuous temperature and pressure compensation.
2. Factory set correction coefficients shall be stored in the sensor's non-volatile memory for correction and linearization of the sensor output in the electronics section.
3. Turndown: 100:1.
4. Measuring Cell:
   a. Hermetically sealed.
   b. Material: Ceramic.
   c. Accuracy: Plus or minus 0.1 percent.
   d. Furnish pressure overload resistance to 60-psig nominal pressure.

D. Electronics
1. Correct the digital signal from the sensor and convert it into a 4-20 mA analog signal for transmission to receiving devices
2. Contain user selectable square root extractors to provide a linear 4-20 mA DC output proportional to flow, when activated.
3. Contain configuration parameters and diagnostic data in non-volatile memory and shall be capable of communicating with a remote interface device.
4. Span and zero shall be continuously adjustable externally over the entire range. Span and zero adjustments shall be capable of being disabled internally.
5. Output signal damping shall be provided, with an adjustable time constant of 0-36 seconds.

E. Display:
1. 4-digit LCD indicator capable of displaying engineering units.
2. Pushbutton or local programming

F. Mounting:
1. All 316 SS mounting brackets shall be provided

G. Connections:
1. Provide all necessary connectors, SS tubing, and appurtenances to connect to process piping

H. Output:
1. 4-20 mA, 24 VDC.

I. Calibration:
1. Total Long-Term Stability shall be no less than 0.2% of upper range limit for 10 years.
2. Each transmitter shall have a stainless-steel tag with calibration data attached to body.

J. Communications Protocol: HART.

K. Operation: Menu guided.

2.2 SUBMERSIBLE MEASUREMENT DEVICES

A. Manufacturers:

1. TE Connectivity - KPSI 320
2. Endress and Hauser – WaterPilot FMX21
3. Substitutions: As specified in Section 01 60 00 - Product Requirements.

B. Type and Body
1. Vented through vent tube in cable to ground level
2. Submersible to 300 feet H2O
3. Maximum Outer Diameter: 1.0 inches

C. Power Requirement: 10-30 VDC

D. Range:
1. 0 ftH2O to max depth of water well.

E. Electronics
1. Accuracy 0.2% across measurement range
2. Factory set correction coefficients shall be stored in the sensor's non-volatile memory for correction and linearization of the sensor output in the electronics section.

F. Accessories:
1. Supply cable clamp, cable junction box,
2. Junction Box to contain accessories.
3. Aneroid bellows or filter element with desiccant cartridge
4. All other accessories necessary for mounting and operation
5. Provide enough cable to reach bottom of well from top of well casing plus 6 feet.

G. Process Connection
1. Suspension clamp and cable mounting screws.

H. Output:
1. 4-20 mA, 24 VDC.

I. Calibration:
1. Total Long-Term Stability shall be no less than 0.2% of upper range limit for 5 years.
2. Each transmitter shall have a stainless-steel tag with calibration data attached to body.

J. Communications Protocol: HART.

2.3 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for installation examination.

B. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. Coordinate location and orientation of level probe assemblies with final equipment installations.

B. Ensure that instruments are located to be easily accessible for maintenance.

3.3 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for inspecting and testing.

B. Section 01 73 00 - Execution: Requirements for testing, adjusting, and balancing.

C. Manufacturer Services: Furnish services of manufacturer's representative experienced in installation of products furnished under this Section for not less than 8 hours on Site for installation, inspection, field testing, and instructing Owner's personnel in maintenance of equipment.

D. Equipment Acceptance:
   1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
   2. Make final adjustments to equipment under direction of manufacturer's representative.

E. Furnish installation certificate from equipment manufacturer's representative attesting that equipment has been properly installed and is ready for startup and testing.

F. Furnish configuration worksheet for each device detailing all site-specific settings and setpoints that deviate from factory setup.

3.4 DEMONSTRATION

A. Section 01 79 00 – Demonstration and Training: Requirements for demonstration and training.

B. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 40 72 43

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SECTION 40 73 13 - PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Pressure gauges.

1.2 REFERENCE STANDARDS

A. ASME International:
   1. ASME B40.100 - Pressure Gauges and Gauge Attachments.

B. NSF International:
   1. NSF 61 - Drinking Water System Components - Health Effects.
   2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit manufacturer information for system materials and component equipment, including connection requirements.

C. Shop Drawings:
   1. Indicate system materials and component equipment.
   2. Submit installation requirements and other details.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Source Quality-Control Submittals: Indicate results of tests and inspections.

F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

G. Qualifications Statement:
   1. Submit qualifications for manufacturer.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of equipment and accessories.

1.5 QUALITY ASSURANCE

A. Ensure that materials of construction of wetted parts are compatible with process liquid.

B. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 20 years' experience.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.

B. Store materials according to manufacturer instructions.

C. Protection:
   1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
   2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

A. Manufacturers:
   1. Ametek US Gauge.
   2. Ashcroft Inc.
   3. McDaniel
   4. Trerice Company
   5. Wika

B. Dials:
   1. Nominal Diameter: 4-1/2 inches.
   2. Face: White, laminated plastic dials with black graduations.
   3. Scale: Extend over arc not less than 270 degrees.
   4. Ranges and Graduation Units: As indicated on Drawings or at the nearest standard range which provides a top limit above the pump shutoff head at the operating conditions bit no greater than 10% above the shut off head.
   5. Engineering Units: PSI

C. Cases:
   1. Material: Phenolic.
   2. Type: Blowout protected.
   3. Liquid filled (glycerin).
   4. Provide removable rear plate.
   5. Windows:
      a. Material: Clear, shatterproof glass.
      b. Thickness: 1/8 inch.
      c. Provide gasket.

D. Connection:
   1. Location: Bottom.
   2. Socket:
      a. 1/2-inch NPT male thread.
      b. Material: Brass forging.
      c. Extend minimum 1-1/4 inches below gage cases.
      d. Provide wrench flats.
   3. Mounting: As indicated on Drawings.

E. Measuring Element:
   1. Bourdon Tubes:
      a. Material: Stainless steel to brass socket.

b. Provide welded, stress-relieved joints.
2. Movement:
a. Adjustable.
b. Material: Stainless steel.
3. Accuracy:
a. Comply with ASME B40.100.
b. Plus and minus 0.5 percent of full-scale range.

F. Adjustment:
1. Provide for zero-reading adjustment.
2. Adjusting Screws: Accessible from rear of case without need for disassembly.

G. Accessories:
1. Pressure Snubber:
a. Material: Type 316 stainless steel.
b. Provide isolation valve.
2. Shutoff Cocks: Furnished by gauge manufacturer.

2.2 SOURCE QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

A. According to manufacturer instructions.

B. Coordinate location and orientation of gages and seal assemblies with final piping and equipment installations.

C. Ensure that gages are located to be easily read during operation and easily accessible for maintenance.

D. Install pressure gauges in the locations as noted on the Drawings.

3.3 FIELD QUALITY CONTROL

A. Equipment Acceptance:
1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
2. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 DEMONSTRATION

A. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 40 73 13

43 21 54 VERTICAL TURBINE PUMPS – WATER WELLS

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes vertical turbine pumps of the short-coupled open line shaft type including base plates, discharge heads, bowl assemblies, impeller and line shaft assemblies, column pipes and drive units, complete with accessories.

1.2 REFERENCES

A. Materials and installation shall be in accordance with the latest revisions of the following codes, standards and specifications, except where more stringent requirements have been specified herein:
   1. American Water Works Association (AWWA) - E103 – Horizontal and Vertical Line-Shaft Pumps
   2. Hydraulic Institute Standards (HIS*)*
   3. American Society for Testing and Materials (ASTM)
   4. National Electrical Manufacturer's Association (NEMA)
   5. National Sanitation Foundation (NSF)

1.3 SUBMITTALS

A. In addition to those submittals identified in the General Provisions, the following items shall also be submitted:
   1. A complete list of all components of the equipment, including materials of construction.
   2. Certified pump performance curves
   3. Anchor bolt details and loads. Information shall include calculations of axial and lateral shear, base moment and gravity loads.
   4. For variable speed pumps, provide calculated vibration characteristics over the range of operating speeds (50–100% speed unless otherwise scheduled), along with a comparison of these values to Hydraulic Institute Standards and the manufacturer's own standards or guidelines. The manufacturer may assume a rigid foundation condition in performing this analysis.
   5. Calculations of column and discharge head friction losses, based on a Hazen-Williams friction coefficient ("C") of 100.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The following manufacturers are named to establish a standard of quality necessary for the Project:

   1. Pumps
      a. Flowserve
      b. Simflo
      c. American Marsh
      d. Hydroflo
   2. Motors
      a. U.S. Electrical Motors
      b. General Electric

2.2 GENERAL

A. All pumps, motors and accessories shall be supplied as a complete package from a single pump manufacturer who shall be responsible for proper operation of the coordinated system.

B. All pump components of like size and type shall be the product of the same manufacturer for purposes of parts interchangeability.

2.3 PERFORMANCE REQUIREMENTS

A. Each complete pumping unit shall be designed to operate over the scheduled operating range.

B. Pumps shall fit into the space provided on the Contract Drawings, without adjustment of adjacent piping.

C. When operating over the specified range of conditions, the pumps shall not cavitate and shall be free of undue noise and vibration. Vibration levels of each installed pump and motor shall be less than 0.24 inches per second as shown in the Hydraulic Institute Standards.

D. Pumps and drive units shall be designed to withstand reverse rotation at full runaway speed due to shutoff head applied at the discharge flange of the pump, unless otherwise specified.

E. Where scheduled, pumps and drive units shall be designed for variable speed operations and shall operate without undue noise and vibration between 50% and 100% of rated synchronous speed.

2.4 MATERIALS AND CONSTRUCTION

A. Discharge Heads

1. Pumps shall have surface discharge heads of fabricated steel for variable speed applications or cast iron if approved by engineer. The discharge head design shall have sufficient capacity to carry the combined weight of the column assembly. Discharge flanges shall be drilled for through bolting to match an ANSI B16.1, Class 125 flat face pipe flange. Flange gaskets shall be full-face.
2. Discharge head shall support the drive unit in a concentric manner, maintaining vertical shaft alignment and supporting the static weight of impellers and shaft.
3. The top surface of the discharge head shall have a machined and registered fit to match the driver. The bottom surface of the discharge head shall be machined flat to provide full contact with the sole plate.
4. Discharge heads shall be equipped with eyebolts or lifting hooks.
5. Discharge heads shall be tapped for pressure gauge connection on the horizontal centerline.
6. Suitable openings shall be provided for access to the stuffing box and other accessories.
7. Discharge head waterways shall be coated with an NSF-listed epoxy coating approved for use in contact with potable water.

B. Pump Bowls

1. The suction bowl, intermediate bowls and discharge bowl shall be made of close-grained cast iron per ASTM A48, Class 30, free of detrimental defects. Water passages shall be lined with a porcelain enamel or fusion bonded epoxy coating.

2. Bowls shall be equipped with replaceable bronze wear rings on the suction side of each impeller. Bowl wear rings shall be at least 50 BHN harder than the impeller wear rings.
3. Where scheduled, a galvanized basket-type strainer shall be provided for each pump, designed for attachment to the pump suction bell. The strainer shall have a net inlet area equal to at least four times the area of the suction pipe cross-section. Maximum opening size shall not exceed 75% of the minimum opening of the water passages through the bowl and impeller.

C. Impellers
1. Impellers shall be stainless steel, enclosed type and shall be dynamically balanced in accordance with ANSI S2.19, Grade G-2.5. Impellers shall be a standard product of the pump manufacturer and shall not contain special workmanship to temporarily increase efficiency.
2. Impellers shall be rigidly connected to the impeller shaft by a connection designed to resist the forces tending to produce reverse rotation.
3. Impeller adjustment shall be by means of the adjusting nut located at the top of the drive motor.
4. Impellers shall be equipped with replaceable wear rings.

D. Shafting
1. Impeller shaft shall be ASTM A582 Type 416 stainless steel, statically balanced, and of ample dimensions to provide rigid support to the impellers.
2. Line shafting shall be Type 416 stainless steel provided in sections with a maximum length of ten feet.
3. Shaft couplings shall be designed to prevent loosening of the coupling under full-speed reverse rotation due to reversal of flow through the pump bowls.

E. Glands and Stuffing Boxes
1. Stuffing boxes shall be cast iron, complete with axially split bronze glands designed and machined for easy removal without disturbing other parts.
2. Stuffing boxes shall be equipped with stilling tubes and water slingers.
3. Water seals shall be mechanical. Drip boxes shall be tapped for ¾-inch connection and shall be piped to drain.
4. Graphite packing maybe used as alternative upon approval by Engineer.
5. All lubricants in direct contact with raw well water shall be NSF 61 certified.

F. Bearings
1. Bowl guide bearings shall be provided above and below each impeller. Line shaft bearings shall be spaced at intervals not greater than 10 feet along the line shaft. Line shaft bearings shall be mounted with 304 stainless steel ring spider bearing retainers.
2. Suction case bearing shall be bronze, water lubricated, or permanently sealed grease lubricated.
3. Intermediate bowl guide bearings shall be water lubricated and shall be of bronze, neoprene or combination of bronze and neoprene.
4. Line shaft bearings shall be water lubricated and shall be of bronze, rubber, or neoprene. Rubber bearings are permitted below the static water level. Engineered bearings of polymer or other approved material shall be used above the static water level.

G. Column Piping (Drop pipe)
1. Column piping shall be provided in sections not exceeding 10 feet in length.
2. Column piping shall be Schedule 40 carbon steel and shall have a tapered transition from the bowl assembly. Couplings shall be straight column threaded (no tapered threads).
3. Column piping shall be sized such that headloss shall not exceed 5 feet per 100 feet of column at the pump rated capacity, calculated based on a Hazen-Williams friction coefficient (“C”) of 100.

4. Column piping shall be coated with a NSF-listed epoxy coating approved for use in contact with potable water.
5. Column shall accept ring spider bearing retainers.
6. Column shall hang free inside well casing.

H. Sole Plates and Anchor Bolts
1. Steel sole plates shall be provided between the pump discharge head and the concrete base pad. The top surface shall be machined flat for full contact with the bottom surface of the discharge head.
2. The opening in the sole plate shall be of sufficient size to permit the pump to be removed without disturbing the sole plate.
3. Anchor bolts shall be hot-dip galvanized or stainless steel, provided by the pump manufacturer. Anchor bolts shall restrain the pump while operating at shut-off head. Anchor bolts shall be furnished complete with nuts and sleeves and shall be of sufficient length to permit proper embedment in the foundation concrete. Epoxy adhesive anchors may be used where pump is to be installed on an existing concrete foundation.

I. Miscellaneous
1. Each pump shall be equipped with a discharge pressure gauge, installed so as to be clearly visible.

J. Drive Units
1. General
   a. Drive units shall be furnished by the pump manufacturer, and shall be coordinated with the pump and associated equipment.
   b. Drive units shall be vertical hollow shaft type.
   c. Motor shall be designed to withstand all forces which may be imposed during the course of normal operation, including starting and stopping.
   d. Motors shall be suitable for across the line starting and shall be able to start and accelerate the connected load to full load speed with 80% of rated voltage at the motor terminals.
   e. Motors shall be capable of continuous operation at full load and rated frequency with a voltage variation of +/-10%.
   f. Drive units shall be rated to carry the full thrust of the pump under all operating conditions. Motors specially designed for high thrust conditions shall be provided where required.
   g. Motors shall be supplied with non-reverse ratchets of ample size to withstand the stresses which can be developed by reverse flow through the pump bowls.
   h. Motors shall be oil lubricated. Sufficient oil shall be provided to fill the motors, plus additional oil required for one refilling of each motor in a properly identified container.
   i. Motors shall be of ample rating such that rated horsepower, not including the specified service factor, shall not be exceeded at any point on the pump full-speed characteristic curve within the specified operating range.
   j. Motors shall be energy efficiency type meeting the requirements of NEMA standard publication MG-1.
   k. All motors supplied for use with variable frequency drives (VFDs) shall be labeled for “inverter duty” or similar. The manufacturer shall provide data on minimum speed requirements, maximum ramp up and ramp down times, and maximum starting frequencies (starts per hour) to meet these minimum speeds. The contractor supplying the motor shall be responsible for coordinating these requirements with the VFD supplier or electrical contractor to ensure these requirements are met.
2. Stator Construction
   a. The stator iron coreplate shall be of high-grade low loss silicon steel. Stator coils shall be form wound VPI insulation. Temperature rise at full load shall be 60 degrees C by resistance.

3. Rotor Construction
    a. Rotors shall be fabricated bar construction copper where available, or cast aluminum.
    b. The method of brazing shall be by induction heating. When copper bars or copper end rings are used they shall be made of “oxygen free” copper to minimize embrittlement of copper on outer edges.
    c. All bars shall be maintained tight in the slot to limit vibration and thus bar fatigue. The rotor cage shall be maintained centered on the rotor laminations by providing end stops to limit ratcheting of bars. The preferred method is pieces of bar symmetrically spaced on the overhanging sections of the bars about the rotor and brazed to the current carrying rotor bars (active bars).
4. Bearings
    a. Bearings shall be sleeve type, self-aligning, spherically seated, ring-oil lubricated split type.
5. Enclosure
    a. Unless otherwise scheduled, motors shall be open, drip-proof. Other designs that provide an equivalent or greater degree of environmental protection, such as guarded or weather protected, are also acceptable.
6. Insulation
    a. Insulation shall be Class F minimum.
7. Nameplate
    a. Motor nameplate shall be stainless steel, securely fastened to the motor frame with pins of like material.
    b. Nameplates shall include the following information, at a minimum:
        Rated horsepower
        Full load speed
        Frequency
        NEMA kVA code
        Rated voltage and phase
        Manufacturer’s serial number and type
        Service factor
        Insulation class
        Maximum ambient temperature
        Full load current at nameplate voltage
        Frame size designation
        Oil requirements
        Stator air gap
8. Terminal Boxes
    a. Terminal boxes shall be of fabricated steel or cast iron construction compatible with the motor enclosure specified and when possible, shall be diagonally split and capable of rotation in 90-degree increments. Boxes not suitable for rotation shall be capable of top entry.
    b. The area in which the main terminal box is connected with the motor frame shall be fully gasketed to prevent entrance of foreign matter into the motor and to provide support for the stator leads where they pass through the motor frame.
    c. A properly sized grounding terminal shall be mounted in the main terminal box.
    d. The main terminal box shall be sufficiently oversized (one size above standard) to allow terminations of power cables.
    e. Auxiliary terminal boxes shall be provided to house connections for accessory devices not mounted in the main terminal box (i.e., RTDs).
9. Leads

    a. Main motor leads shall have EPDM type jackets and shall be permanently tagged for identification.
10. Thermal Protective Devices

a. Where scheduled, RTDs shall be pre-wired to an external control module with terminal box mounted to the motor housing. Control module shall provide one “normally closed” dry contact which will open upon over temperature in any one of the RTDs. The dry contact shall be rated 2 amps, minimum 120 VAC. The control module shall operate from an external 120 VAC supply power connection.

2.5 SOURCE QUALITY CONTROL

A. Perform shop testing and provide testing data and curves to Engineer for approval prior to shipping to site.

2.6 SPARE PARTS

1. Furnish a sufficient supply of packing to repack each pump supplied. Deliver to Owner in person.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install pumping equipment in accordance with the configuration shown on the Contract Drawings and the Standards of the Hydraulic Institute.

B. Level and bolt equipment bases down against metal shims in accordance with the Hydraulic Institute Standards. Use of leveling nuts will not be allowed. Fill the space between the sole plate and the concrete pad with non-shrink, non-ferrous grout in accordance with the Section entitled “Cast-In-Place Concrete”. Prior to grouting check equipment alignment and realign if required.

C. Clean all debris from suction and discharge piping prior to filling with water.

D. Pipe stuffing box drain to the nearest drain with ¾” copper tubing.

3.2 FIELD TESTING

A. Perform field testing in accordance with the requirements of the Section entitled “Tests on Pumping Equipment”.

3.3 MANUFACTURER'S FIELD SERVICE

A. The Contractor shall engage the services of a manufacturer’s erecting engineer or qualified manufacturer’s representative to be present at and assist in the startup of each pump included in this section. The duration of service shall be as required to complete the successful startup of the pumps.

B. The manufacturer’s erecting engineer or factory representative shall start and operate the equipment and conduct field tests to adequately demonstrate that the equipment has been properly installed and will function as herein specified. All tests shall be subject to the Engineer’s review.

3.4 PAINTING

A. With the exception of those parts and components customarily furnished unpainted, all metal surfaces shall be shop prepared and coated with rust inhibitive shop paint. Shop paint shall be fully compatible with the field paint specified. Machined surfaces shall be protected against damage and corrosion by other means.

B. Perform field painting in accordance with the Section entitled "Field Painting".

3.5 SCHEDULE

PALMER 3A

Nominal rated speed (max)	1800 RPM
Performance at rated speed	0 gpm @ 150 feet TDH (min) 800 gpm @ 106 feet TDH (design point) Pump Curve must cross minimum system curve (start-up head): 900 gpm @ 50 feet TDH to 1300 gpm @ 65 feet TDH

Note: TDH values specified do not include column and discharge head friction losses; these losses must be calculated by the pump manufacturer and included when establishing the "bowl assembly total head" reflected in the pump hydraulic performance curves.

Hydraulic efficiency	Peak efficiency shall occur between 700 and 900 gpm and shall be at least 75%.
Well casing size	12-inch
Column pipe size	8-inch
Discharge flange size	8-inch
Discharge head	Fabricated steel or cast iron, Class 125 Flange
Setting	As shown
Required submergence (max)	15 feet
Accessories	1 ¼" NPT tapped penetration through pump discharge head for PVC stilling well (see contract drawings)
Motors	
Type	Vertical [inverter duty]
Enclosure	Drip Proof
Horsepower (max)	30 HP
Characteristics	460V, 3 phase, 60 Hz
Service factor	1.15
Stator RTDs	No
Bearing RTDs	No

Juniper 1

Nominal rated speed (max)	1800 RPM
Performance at rated speed	0 gpm @ 130 feet TDH (min) 1000 gpm @ 79.5 feet TDH (design point) Pump Curve must cross minimum system curve (start-up head): 1100 gpm @ 55 feet TDH to 1400 gpm @ 65 feet TDH

Note: TDH values specified do not include column and discharge head friction losses; these losses must be calculated by the pump manufacturer and included when establishing the "bowl assembly total head" reflected in the pump hydraulic performance curves.

Hydraulic efficiency	Peak efficiency shall occur between 900 and 1100 gpm and shall be at least 75%.
Well casing size	12-inch
Column pipe size	8-inch
Discharge flange size	8-inch
Discharge head	Fabricated steel or cast iron, Class 125 Flange
Setting	As shown
Required submergence (max)	15 feet
Accessories	1 ¼" NPT tapped penetration through pump discharge head for PVC stilling well (see contract drawings)
Motors	
Type	Vertical [inverter duty]
Enclosure	Drip Proof
Horsepower (max)	30 HP
Characteristics	460V, 3 phase, 60 Hz
Service factor	1.15
Stator RTDs	No

Bearing RTDs	No

ATTACHMENTS:

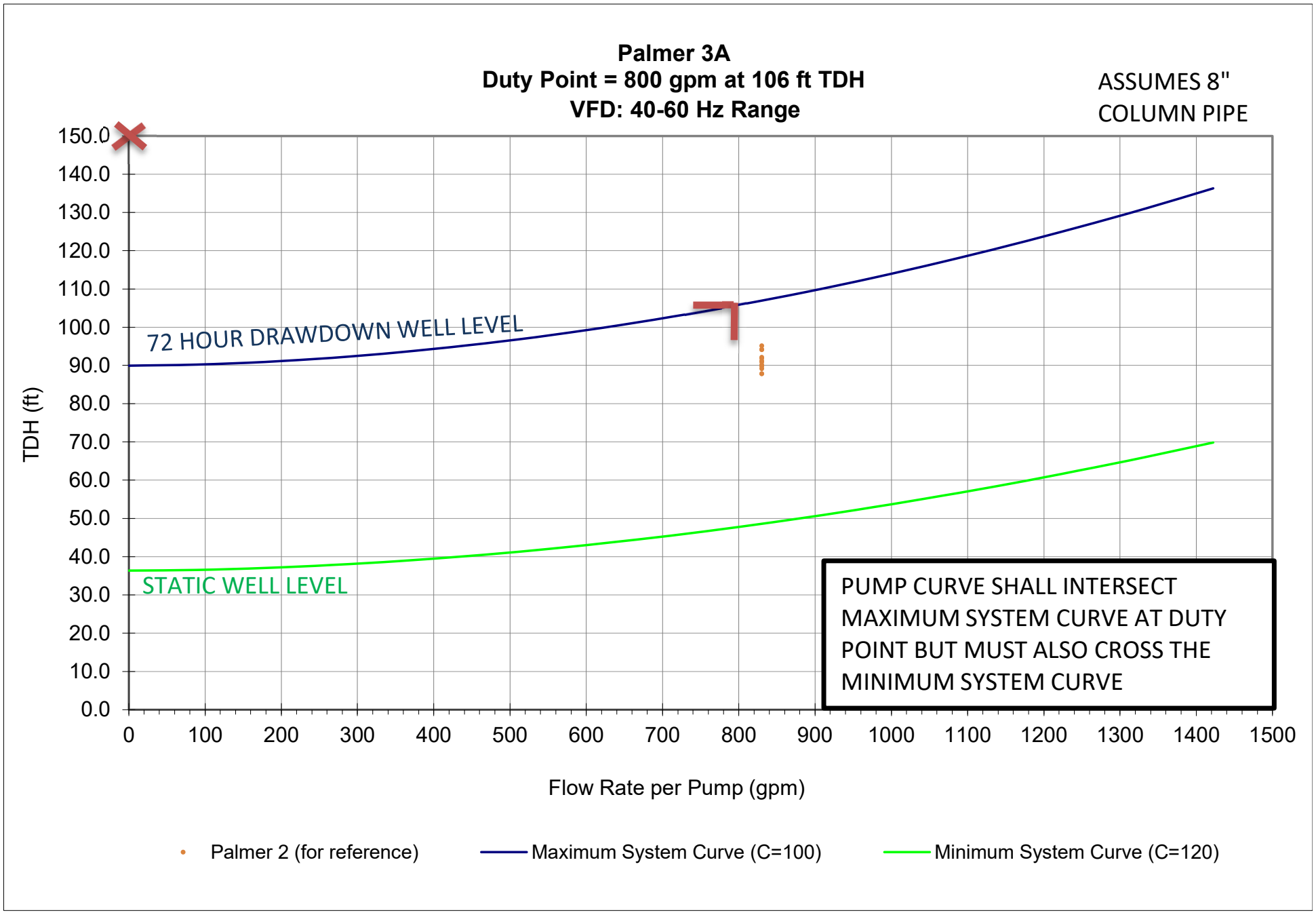
PALMER 3A SYSTEM CURVE

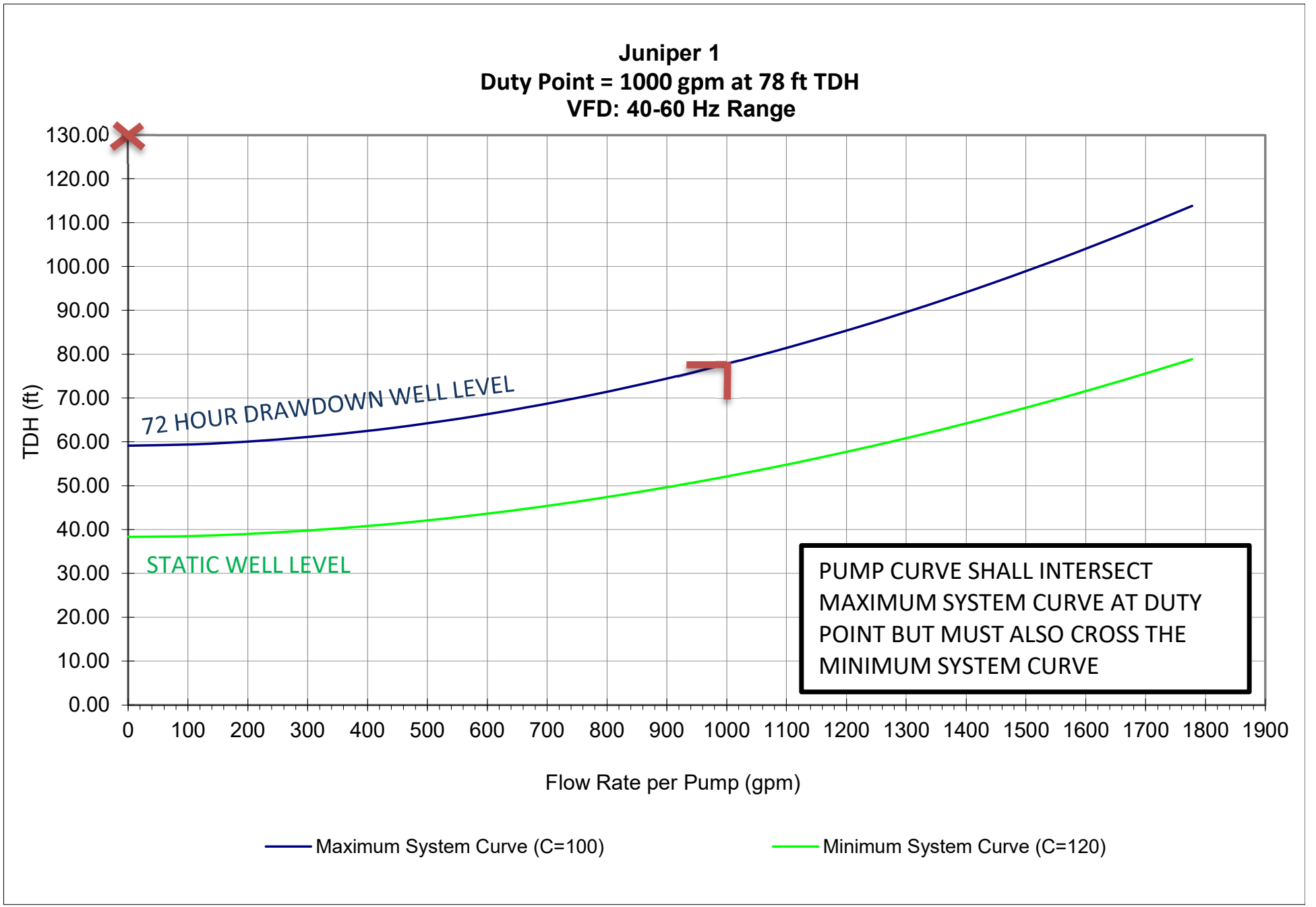
JUNIPER 1 SYSTEM CURVE

PALMER 3A WELL LOG

JUNIPER 1 WELL LOG

END OF SECTION 43 21 54


Palmer 3A
Duty Point = 800 gpm at 106 ft TDH
VFD: 40-60 Hz Range
ASSUMES 8" COLUMN PIPE
72 HOUR DRAWDOWN WELL LEVEL
STATIC WELL LEVEL
PUMP CURVE SHALL INTERSECT MAXIMUM SYSTEM CURVE AT DUTY POINT BUT MUST ALSO CROSS THE MINIMUM SYSTEM CURVE
TDH (ft)
150.0
140.0
130.0
120.0
110.0
100.0
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
Flow Rate per Pump (gpm)
Palmer 2 (for reference)
Maximum System Curve (C=100)
Minimum System Curve (C=120)


Juniper 1
Duty Point = 1000 gpm at 78 ft TDH
VFD: 40-60 Hz Range
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
TDH (ft)
72 HOUR DRAWDOWN WELL LEVEL
STATIC WELL LEVEL
PUMP CURVE SHALL INTERSECT MAXIMUM SYSTEM CURVE AT DUTY POINT BUT MUST ALSO CROSS THE MINIMUM SYSTEM CURVE
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
Flow Rate per Pump (gpm)
Maximum System Curve (C=100)
Minimum System Curve (C=120)

Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.
Failure to comply is a misdemeanor.

Import ID:

Tax No:	Permit No:	County: Shiawassee	Township: Owosso

Town/Range:	Section:	Well Status:	WSSN:	Source ID/Well No:
07N 02E	25	Inactive	5120	test-prod Palmer

Well ID: 78000007063

Elevation:

Latitude: 42.978193

Longitude: -84.174823

Method of Collection: Interpolation-Map

Distance and Direction from Road Intersection:
65 ft W of Palmer St / 1,200 ft S of Hopkins Lake Drive

Replacement Well 3a

Well Owner: City of Owosso

Well Address:
Palmer Street
Owosso, MI 48867

Owner Address:
301 West Main Street
Owosso, MI 48867

Drilling Method: Rotary
Well Depth: 138.00 ft. **Well Use:** Type I public
Well Type: Replacement **Date Completed:** 1/13/2022

Casing Type: Steel - black **Height:** 2.00 ft. above grade
Casing Joint: Welded
Casing Fitting: None

Diameter: 12.00 in. to 118.00 ft. depth

Borehole: 22.00 in. to 138.00 ft. depth

Pump Installed: No
Pressure Tank Installed: No
Pressure Relief Valve Installed: No

Static Water Level: 36.00 ft. Below Grade
Well Yield Test: **Yield Test Method:** Test pump
Pumping level 90.00 ft. after 72.00 hrs. at 900 GPM

Formation Description	Thickness	Depth to Bottom
Clay	60.00	60.00
Clay & Gravel	5.00	65.00
Sand & Gravel W/Cobbles	73.00	138.00

Screen Installed: Yes **Filter Packed:** Yes
Screen Diameter: 12.00 in. **Blank:**
Screen Material Type: Stainless steel-wire wrapped
Screen Installation Type: Attached

Slot	Length	Set Between
50.00	20.00 ft.	118.00 ft. and 136.00 ft.

Fittings: None

Well Grouted: Yes **Grouting Method:** Grout pipe outside casing

Grouting Material	Bags	Additives	Depth
Neat cement	189.00	None	0.00 ft. to 116.00 ft.

Geology Remarks:

Wellhead Completion: 12 inches above grade

Drilling Machine Operator Name: Don Blair
Employment: Employee

Nearest Source of Possible Contamination:

Type	Distance	Direction
None		

Contractor Type: Water Well Drilling Contractor **Reg No:** 19-2692
Business Name: Northern Pump and Well
Business Address: 6837 W Grand River, Lansing, MI, 48906-9145

Abandoned Well Plugged: No
Reason Not Plugged: Other

Water Well Contractor's Certification

This well and/or pump installation was performed under my registration.

Signature of Registered Contractor **Date**

General Remarks: Upon completion of testing / State approvals, to set as city production well

Other Remarks: Not Plugged Reason:To be addressed later by owner

Water Well And Pump Record

Completion is required under authority of Part 127 Act 368 PA 1978.
Failure to comply is a misdemeanor.

Import ID:

Tax No:	Permit No:	County: Shiawassee	Township: Caledonia

Town/Range:	Section:	Well Status:	WSSN:	Source ID/Well No:
07N 03E	18	Inactive	5120	test-prod Juniper

Well ID: 78000007061

Juniper TPW

Elevation:
Latitude: 43.00838
Longitude: -84.153573
Method of Collection: Interpolation-Map

Distance and Direction from Road Intersection:
1,090 ft East of N Gould St / 700 ft S of Jackson Dr

Well Owner: City of Owosso

Well Address:
Juniper Street
Owosso, MI 48867

Owner Address:
301 West Main Street
Owosso, MI 48867

Drilling Method: Rotary
Well Depth: 100.00 ft. **Well Use:** Type I public
Well Type: New **Date Completed:** 1/28/2022

Casing Type: Steel - black **Height:** 2.00 ft. above grade
Casing Joint: Welded
Casing Fitting: None

Diameter: 12.00 in. to 80.00 ft. depth

Borehole: 22.00 in. to 100.00 ft. depth

Pump Installed: No
Pressure Tank Installed: No
Pressure Relief Valve Installed: No

Static Water Level: 5.00 ft. Below Grade
Well Yield Test: **Yield Test Method:** Test pump
Pumping level 40.00 ft. after 72.00 hrs. at 1100 GPM

Formation Description	Thickness	Depth to Bottom
Clay	20.00	20.00
Sand & Gravel	80.00	100.00

Screen Installed: Yes **Filter Packed:** Yes
Screen Diameter: 12.00 in. **Blank:**
Screen Material Type: Stainless steel-wire wrapped
Screen Installation Type: Attached

Slot	Length	Set Between
40.00	20.00 ft.	80.00 ft. and 100.00 ft.

Fittings: None

Well Grouted: Yes **Grouting Method:** Grout pipe outside casing

Grouting Material	Bags	Additives	Depth
Neat cement	160.00	None	0.00 ft. to 75.00 ft.

Geology Remarks:

Wellhead Completion: 12 inches above grade

Nearest Source of Possible Contamination:

Type	Distance	Direction
None		

Drilling Machine Operator Name: Don Blair
Employment: Employee

Contractor Type: Water Well Drilling Contractor **Reg No:** 19-2692
Business Name: Northern Pump and Well
Business Address: 6837 W Grand River, Lansing, MI, 48906-9145

Water Well Contractor's Certification

This well and/or pump installation was performed under my registration.

Signature of Registered Contractor **Date**

General Remarks: Upon complete testing and State approval to set as city production well.
Other Remarks: